THE

ELECTRICAL REVIEW.

VOL. LXV. DECEMBER 24, 1909. No. 1,674.

ELECTRICAL REVIEW.

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THE INDUSTRY AND THE INSTITUTION.

WE complete in this issue the publication of our abstract of Messrs. Lepine and Stelling's paper read at the Institution on the 9th inst., and of the discussion thereon. The paper is entitled "Notes on Methods and Practice in the German Electrical Industry," and gives some most useful information within the limits of its title. Covering as it does important features in factory, office, and business methods, it offered a wide scope for profitable discussion, but its concluding paragraph expressed the opinion that "if the English financiers and commercial leaders of the electrical industry were as enterprising and as successful as their German rivals, English manufacturers, supported as they are by the superiority of their productions, would not have to fear German competition in the open market." In consequence of this expression of opinion, the majority of the speakers regarded the occasion as affording an excellent opportunity for calling attention to grievances against the Institution, its Presidents, the Legislature, and the fiscal system of the country, and only a minority dealt with the practical features of the paper. Mr. Garcke took exception to the paragraph which we have quoted above, and then proceeded to find fault with the President and the past-president for the opinions they had expressed upon the condition of the electrical industry, and with the Institution itself for its reliance "on the efficacy of scientific discussion," and its omission "to undertake those active duties which are necessary in order to secure beneficent legislation and vigorous and healthy development." The demonstration of the wisdom of the Council in placing reasonable limits to the Institution's functions is to be found in Mr. Garcke's speech. He raised questions of economics and politics which we do not question the ability or the readiness of members of the Institution to discuss, but such discussions should take place elsewhere, and the aloofness of the Institution from political questions is justified on the grounds of its own welfare, and its ability to confer the maximum benefit upon its members.

It has been said of Burke that he was too apt to defend bad causes with a scream of passion, and that a politician who screams makes but little impression upon a legislative assembly. It is often otherwise elsewhere, and the applause given to a speaker who is in earnest should not be grudged him. But when great interests are involved, the invective needs to be ignored, and the arguments require to be carefully considered. Mr. Garcke and his associates (who contrived to get in political speeches in spite of the President's ruling) would have us believe that any depression which may exist in electrical manufactures is the result of restrictive legislation, or municipal enterprise; "that chaos of prejudices known as public opinion"; the need of financial facilities such as are afforded in Germany, for

instance, by industrial banks or kindred institutions; and, finally, the absence of that protection for the home market which our international competitors enjoy.

For some years past the same line of argument has been industriously pursued with the object of leading to the formation of some organisation which shall represent the whole of the industry and promote its welfare by ameliorating "many of the difficulties under which it labours." Such an organisation has not been formed, and, from the nature of things, cannot be formed. And now on the first opportunity that presents itself the Institution is appealed to to "abandon the erroneous belief that the scientific interests of the electrical industry can be best advanced by an attitude of apathy towards the commercial aspects." We doubt if the Council of the Institution have any such belief as is here presented. The relationship of the scientific and commercial sides the one to the other is far too obvious to escape the attention of those concerned. What is not so obvious is the most suitable method of promoting those interests.

What are Mr. Garcke's methods? First, to make our flesh creep by a demonstration of the deplorable condition of the electrical industry; secondly, to demonstrate that non-success of any enterprises is not to be attributed to any lack of foresight, prudence, or careful management, but to the overmastering conditions with which the responsible persons are powerless to contend. And what are the underlying principles of the remedies? Just exactly what might be expected from the diagnosis of the alleged disease. The tendency of the remedies is to lead the mind from internal causes and to seek amelioration from external aid. Capital, it is said, does not flow into the business. Capital does go into paying sections, but if there is no flood of capital for new, though promising, enterprises, how much of the cause may be attributable to that campaign for "amelioration of disabilities" of which the first article is a recital that electrical enterprises do not pay, the second that they cannot pay unless conditions are changed, and the third that the changes alleged to be required go to the root of the principles of English business? Capital is sensitive, and its possessors are liable to form impressions from the prevailing talk of the market-place. When those interested in electrical enterprises not only talk about their disabilities, but positively shout them and persistently continue to do so, some at least of the available sources of capital must be dried up. The order placed in Germany for the electrical material required for what is, or was, called the Victoria Falls Power Scheme, was mentioned during the discussion. Regarding this plant a correspondent of the *Daily Telegraph* "believed that every effort was made by the British South Africa Co. to secure that the contract for the Victoria Falls electrical materials should be placed with a British company, and that the failure was entirely due to the lack of the necessary financial support to the contracting English firm." The result of our own inquiries is that whatever efforts were made in this direction must have been of a somewhat perfunctory character, since firms perfectly able to manufacture the plant had no such opportunity as was afforded their German competitors. The incident is purely financial, and is in no sense indicative of manufacturing "disabilities" or the need of any revolutions in methods, unless it be in the direction of financial conduits, such as are referred to as Industrial Banks. The City editor of the *Daily Telegraph* summed up the matter in the words, "The British public did not respond to the Victoria Falls Co.'s invitation to provide some £900,000 for the installation of a big electric plant for the mines on the Rand. The Germans willingly agreed to provide the amount, but on the express condition that the necessary plant, which involves an expenditure of nearly a million sterling, should be obtained from German manufacturers." The English financial market, to whom the scheme was openly offered, regarded it coldly. Would they have received it any the more warmly if approached from the side of manufacturing interests instead of as presented? We put the question. The answer must be left, and it will probably vary with the varying views of our readers. There is, however, no reason why English electrical interests should be lectured or any electrical financier put on the cap and wear it any more than Rothschild or the more modest investor. Anyone with available cash had his chance and refused it, either on the merits of the investment itself or by reason of the auspices under which it was presented. The manufacturing work has gone, but the earning stage has not yet begun, and we should wait awhile before congratulating our German friends upon their enterprise or condemning our English friends for their excess of prudence. Meantime it may be hoped that financial interests which rejected the opportunity of investing directly will not too greedily swallow the investment when presented indirectly, in which case the Industrial Bank concerned, or other German financiers, will have considerable funds locked up and will perhaps be willing to let others have a chance of financing any similar enterprise which may offer.

It is well to remember that the mere fact of securing orders on speculative terms does not justify the injunctions to follow all the methods of our German friends which we are implored to do. We are told that the firms are large and have become large by a series of amalgamations. This is a free country, and there is nothing to prevent the amalgamation of any firms who find it to their advantage. Enormous engineering works are not such a novelty in England as to justify any sentiment of awe at the extent of electrical factories in Germany or elsewhere. So long as we are equipped for the manufacture of any machinery in demand, it is immaterial whether our factories are few and large or numerous and comparatively small. It is early yet to determine that the large is necessarily the most economical, since the principal examples have developed rather as the result of fiscal conditions than from purely economic causes. There may, nevertheless, be room for connecting links of a semi-financial character.

The advocates of German methods are, of course, expecting to reap all the advantages without any of the drawbacks. Our Chancellor of the Exchequer has not yet placed a tax on incandescent lamps, such as exists in Germany. Our students who look wistfully to the time when they may embark on practical work, and plenty of it, as they are persuaded to expect, may ask themselves whether employment on the terms indicated by Messrs. Lepine and Stelling entirely satisfies their aspirations for the future. Those concerned in electrical manufactures may wonder whether, after all, the industrial banks lauded by Mr. Raworth are just the institutions by which it is desirable that electrical finance should be controlled. It would appear, from Mr. Raworth's remarks, that these institutions are engaged not only in developing some enterprises, but also in deterring the development of others. There is reason to still further inquire whether these methods can be profitably transferred to this country. An absence of freedom of action and freedom of choice runs through them all, until we reach conditions which fetter not only those within, but also those without.

No surprise need be felt that those who seek adventitious aid for business enterprises should look to Tariff Reform for help, but as we have remarked, it is to be regretted that a meeting such as the one addressed should have such subjects forced upon it. We have expressed our views on this question before, and have no intention of intruding them now. It is only necessary to meet the arguments advanced by remarking that the electrical industry is dependent upon the general prosperity of the country, and any direct benefit it might appear to receive from Tariff Reform would be as nothing compared with the loss which might accrue from a change in our fiscal policy. The subject needs to be approached very broadly, which can hardly be claimed for it in the discussion to which reference is made.

We hope, but are hardly justified in expecting, that electrical interests may be allowed a respite from the efforts of its anxious friends such as we have dealt with above. We do not deny that there have been some essential drawbacks, but they have been lived down. We do not say that there are no legislative restrictions which are not capable of improvement, but they should be defined and amendment sought in a direct way from the proper quarters and not by the attempt to create a fictitious public opinion. We are far from suggesting that there are no weak members, but we assert that there is no occasion to mix them up in a general way and thereby besmirch a whole industry. Some weak

branches have died off; a little pruning will save some others. "Vigorous and healthy growth" comes from the rigorous and drastic application of sound business principles and not from seeking props or dwelling on drawbacks.

"CHRISTMAS CHEER."

In wishing our readers who are within 24 hours' postal reach of these offices "A Merry Christmas," we remember that large number of our friends farther off, who will not see these pages until Christmas-tide has been all but forgotten. To these, therefore—and, indeed, to all—let us employ the more comprehensive expression "The Compliments of the Season." Though the year is not yet quite dead, in the words of the politician its "sands are running out," and for foreign reasons, if for no other, in this last issue but one for 1909 the Electrical Review heartily wishes to all of its supporters everywhere "A Bright and Prosperous New Year in 1910."

"A passing compliment from editor to supporter—a courtesy and nothing more"—some cynic may remark in these empty unbelieving days. We will let our cynic say his say, and proceed, for we are content to believe that there is still some genuineness, some cordial heartiness, some hope and confidence left even among those who endeavour to watch over the interests of our electrical affairs. We are not all of us so caught in the trammels of self-interest as to be entirely oblivious of the interests of others. Not all of us suspect all of our fellows of saying one thing and meaning another, whatever we may suspect of some. We have no difficulty in believing that the improvement in the state of British electrical engineering and industry which began in 1909 is going to continue in 1910. We also hope that the signs of general improvement which are now so apparent both in the Trade Returns and in the increase of employment, will put heart into some who have allowed their hopes to droop, and will disturb or silence those whose constant complainings have excited anxiety in the minds of men whose own concerns bear no actual evidence of depression.

A few years ago prophets of decadence took our tin-plate trade in hand and wrapped it in a shroud ready for burial—one almost heard the words "Dust to Dust." But a temporary disability had been mistaken for dying gasps, and the poor corpse was no corpse at all. A corpse indeed—mark its vitality, its energy, in the closing months of 1909! Well may the affectionate embalmers now flee in fright. Never did any industry stand up more erect, more ready for the fray—and why?—the superiority of Welsh tin-plates for export meat-packing is bringing such important orders from America that 45 sheet and tin-plate mills are in course of erection or projected. Two out of eight new mills were started only last week and the others will be ready directly. In what more emphatic manner could an industry denounce its detractors?

We do not propose to produce here for Christmas reading and digestion an examination of the factors that have been present making for good and evil in our industry during the year. All we desire just at this point is to say that whatever the past may have been, we arrive at Christmas-tide with figures which indicate that the tide has turned, that the trade of the country is growing again, that more of our people are finding work, that the depression in the curve is past. Various departments of the electrical trade are directly dependent upon improvement in other and more general branches, and some of them have already told us that they are feeling the benefit of that awakening. It is reasonable therefore to expect better things for the British electrical trade in 1910 than it experienced in 1909.

The trade returns for the month of November showed an increase of £11,700,745 (23·4 per cent.) in imports, of £4,174,000 (14·3 per cent.) in exports, and of £69,697 (1 per cent) in re-exports, as compared with the corresponding month of 1908. Taking the 11 months of the year there have been increases of 5·1 per cent. and 14·3 per cent. in the imports and re-exports respectively. The exports are still a shade below those of 1908, namely, 0·9 per cent., but if we add that the month of November showed large increases in manufactured goods, and a reduced price per ton for export coal, the export position is better than it appears from a mere percentage figure. Incidentally, it may be added that the 0·9 per cent. is not accounted for by any fall in electrical exports, for these have increased considerably during the current year, as we have repeatedly shown.

The statistics issued by the Labour Department of the Board of Trade for November, show that employment was better than in October, the improvement being observed in the pig-iron, tin-plate, engineering and shipbuilding industries; indeed, all the chief industries of the country, except cotton spinning, reflected improvement as compared with the corresponding month of 1908. The Trade Unions returned their unemployed members at 6·5 per cent., as compared with 7·1 per cent. in the preceding month, and with 8·7 per cent. in the month of November, 1908. This is exceedingly satisfactory. The pauperism figures issued a few weeks ago for the metropolitan district also reflect an altogether happier state of things.

We print the foregoing figures at this moment in the belief that their appearance in our pages on the eve of Christmas may go far to give those of our readers who wish it "A Merry Christmas," and to encourage a more hopeful outlook, based upon actual statistical evidence, for the year that is coming.

Capital and Labour Co-partnery.

About a year ago we discussed the scheme of co-partnery proposed by Sir Christopher Furness, and gave it our support. We pointed out that, in agreeing to give the system a trial, the men were ahead of their leaders, who look with suspicion on all schemes of profit-sharing proposed by the masters; and we expressed our opinion that the trial could be productive of nothing but good, because, in the first place, it meant steady and continuous employment for the men, who would thus be assured of a full year's wages; continuous occupation of the yard, thus tending to economy in production; and finally, because the facts learned by experience would serve to dispel many of the fictions born of prejudice. Such practical experiments as that which has completed almost a year's successful run at the Hartlepool shipyard should do a great deal to dispel many erroneous ideas from the minds of thinking workmen as to the relationship between labour and capital. The period for which it was agreed that the co-partnership should be tried is now drawing to a close, and the secretary of the company has addressed a letter to the employé shareholders setting forth the results so far achieved.

In this letter it is shown that all departments have been well employed, and that in the shipbuilding department there have been no cases of delay in delivery, as was, unfortunately, often the case before. On the contrary, not only has every ship built and repaired since the commencement

of the co-partnership scheme been completed and delivered within the contract time, but in one important contract in which the company undertook to lengthen a steamer within six weeks, so that it might resume its position by a fixed date on the line in which it was engaged, the work was completed in six days less than the stipulated time. This is most gratifying evidence as to the value of the scheme, and of the loyalty of the men.

Turning to the financial side, the results are no less satisfactory. The success, or otherwise, of schemes of co-partnership or profit-sharing depends very largely upon the part which the cost of labour plays in the total costs of production, and depends still more on the nature of the labour. In the making of standardised plant and machinery, such as engines, boilers, or electric generators, the costs of labour can be very closely and accurately estimated, but, in ship-building and repairing, where so much manual labour is employed, and where the supervision cannot be so close as in a workshop, the cost of labour can, by the deliberate act of the men, be made much more than it ought to be. It is clear then that for work of this character any scheme which gives the men a direct interest in the profits, not only makes them more contented, but must inevitably tend to reduce the cost of labour to a minimum for each job. It is the recognition of this fact which prevents the Trade Union leaders from lending their support to such schemes. It is supposed that if the costs of labour be reduced, there will be less labour employed. Whilst this may be true of any particular job, it is not true as applied to the whole works, or as applied to the industry generally. It is to be sincerely hoped that the results at the Hartlepool yard will do something to promote a more liberal attitude towards profit-sharing schemes of working.

According to the terms of the agreement, the employé shareholders in the Furness co-partnership scheme were guaranteed 4 per cent. on their holding, and, after the ordinary shareholders had received 5 per cent., any surplus was to be divided equally between the employé and the ordinary shareholders. As a result of the nine months' work there will be a bonus all round at the rate of 5 per cent. per annum, so that the workmen receive 9 per cent. and the ordinary shareholders 10 per cent. per annum for the nine months ending December 31st, 1909, which, for convenience, has been made the end of the financial year.

This state of things is in marked contrast to that which existed prior to the co-partnership experiment. Before, owing to sectional strikes and disagreements, in which the employers had no part or lot, the company found it impossible to give any definite guarantee as to time of delivery of a vessel. In several cases considerable penalties had been incurred by reason of the contract time being greatly exceeded. Specific instances are referred to in the secretary's letter to the employé shareholders, viz., the steamer *Victoria* and the three Hamburg-America steamers which were respectively 152 days, 273 days, 304 days and 273 days late.

Under these circumstances the directors are desirous now of knowing at an early date whether it is the desire of the employé shareholders to continue working under the co-partnership system. It is pointed out that sufficient time has now elapsed to enable the men of practical thought to form a sound judgment, and it is imperative in view of the necessity of looking forward to the securing of future contracts, that the directors should know whether or not they may count upon the co-operation of the men, without which it will be impossible to guarantee delivery within a specified time, and thus valuable work will be lost to the yard.

We do not overlook the fact that a good start was given to the co-partnership working by the orders given for vessels by the chairman, Sir Christopher Furness. But this is not the only work accomplished since the scheme was put in hand. During the period of co-operative working nine steamers have been launched and six others are in various stages of construction. At the Middleton ship-yard 119 steamers have been docked and repaired, at the harbour dockyard 157, and at the public docks 8, making a satisfactory total of 284 steamers for the period. In addition to this a considerable amount of salvage work has been done.

We shall be interested in hearing the men's side of the story, and, if they are as satisfied with the results as are the directors and ordinary shareholders, there is no doubt that the co-partnery method of working will be continued. In this event there is every likelihood that other yards will inaugurate similar systems, and it will be very gratifying if proposals for such should emanate from the men. Bearing in mind, however, that the Trade Unions are very strong in the ship-building and engineering trades, it is doubtful if the men will be encouraged by their official leaders to take the initiative.

Fire and Flexible Cord.

Whatever may have been the cause of the fire at the premises of Messrs. Arding and Hobbs, Clapham Junction, we tender to the firm and the bereaved and to all who have suffered in any way in consequence of this sad calamity, our heart-felt sympathy.

As to the cause of the fire, we know no more than is to be gleaned from the daily Press. We have become so accustomed to read the unconsidered remark, "the fire was caused by the fusion of an electric wire," that we should be surprised to hear of any fire for which electricity was not saddled with the blame. In the lamentable case referred to, an explanation has been given which, at any rate, is a possible one. One version is that an assistant dropped an umbrella on to an electric lamp, causing a fusion of the wires, whilst another account says "the fire started in a window of the fancy linen goods department by the fusion of an electric wire, the outside of which was decorated with cotton wool." Now, without offering any opinion as to the origin of the fire, we take this occasion to repeat what we have so often said before—viz., that it is high time that the use of flexible cord in shop windows containing inflammable articles such as every draper's shop contains, to say nothing of celluloid goods, should be absolutely prohibited. Shop window lighting is, perhaps, the cheapest possible kind of electrical work, and is also, as generally carried out, the most dangerous. The surprising thing is that the accidents and fires arising from it have been so few. Electrical contractors are not altogether free from blame in the matter, but unless they absolutely decline to carry out work at the prices which are current for this class of lighting, it is difficult to see how the standard is to be raised, except, indeed, by drastic action on the part of the insurance companies.

Speaking quite generally, it is an amazing thing that whilst a man will spare no expense on his building and furnishings, willingly paying an architect's fee to ensure structural safety, he will place his electric light contract with any Tom, Dick or Harry at the lowest price tendered, begrudging the nominal fee which any responsible consulting engineer would charge him for drawing up a specification and supervising the work. He is quite prepared to accept the contractor's assurance that the work will be in accordance with insurance requirements, and having paid his insurance premium, he feels satisfied that both his risk and his responsibility are covered.

And what of the insurance companies? With one or two exceptions, they profess to insist on the rules of the Institution of Electrical Engineers being complied with, but how many of them will refuse a risk because the work is not in strict compliance therewith? If any difficulty is raised, it is generally enough for the insurer to say, "Very well; if you won't insure me, someone else will," in order to bring the insurance company to heel. Insurance is no guarantee of security, and it requires to be emphasised that the insuring of any premises, whilst it covers financial risk, does not insure against moral responsibility.

Electricity in Mines.

In our "Notes" will be found a reference to the forthcoming inquiry into the use of electricity in mines, which we commend to the notice of those interested in this subject.

THE RAWTENSTALL ELECTRIC LIGHTING AND TRAMWAYS UNDERTAKING.

The history of the electric lighting undertaking of the Borough of Rawtenstall dates back to the year 1899, when the Corporation obtained a provisional order. No steps were taken, however, until 1904, when negotiations commenced between the Corporation and the Lancashire Electric Power Co. for a supply in bulk. In 1905 the Corporation applied for, and obtained, the Local Government Board's sanction to a loan for the purchase of sub-station machinery and distributing mains. Early in 1906 the Corporation had under consideration the purchase of that portion of the Rossendale Valley tramway system lying within their borough, and after considering a report by their engineers, Messrs. Lacey, Sillar and Leigh, decided to introduce a Tramways Bill in Parliament authorising the reconstruction and extension of the old tramways system and its conversion to electric working. At the same time, the original scheme for a bulk supply from the Lancashire Electric Power Co. was abandoned, and in August, 1907, a fresh application for borrowing powers in connection with the electric lighting scheme was made, sanction to the loan being obtained subsequently. The Act authorising the reconstruction and extension of the tramways was obtained in 1907.

Fig. 1.—View in the Town, showing the Tramways.

In the meantime the engineers prepared the plans and specifications for a generating station for the supply of electricity to the tramways, and for general lighting and power purposes. Tenders were received by the Corporation and the various contracts let during the early part of 1908. In July of that year an agreement was come to between the Corporation and the Rossendale Valley Tramways Co., as to the purchase price for the lines, car depôt and rolling stock, and the work of reconstruction was commenced in August. At this period negotiations were also in progress between the Rawtenstall Corporation and the Corporation of the adjacent Borough of Haslingden for a supply in bulk, and for the working of their tramway system, but the negotiations fell through.

Similar negotiations were entered into between Rawtenstall and the Corporation of Bacup, and in September, 1908, an agreement was arrived at between the two Corporations as to the reconstruction and working of the tramways in Bacup.

The first portion of the reconstructed tramways were inspected by the Board of Trade on December 10th, 1908, and the final portion in Bacup was inspected on July 20th, 1909.

The completion of these lines allows of through communication by tramway between Blackburn, Accrington, Haslingden, Rawtenstall and Bacup, all of which are important manufacturing towns. There is also a tramway running in a northerly direction from the centre of Rawtenstall to a point about two miles from the present termination of the Burnley Corporation's tramway system.

The lines are all single track, with turnouts, and comprise the following: Reconstructed lines in Rawtenstall, 5 miles 2·2 chain; new lines in Rawtenstall, 1 mile 4·4 chains; reconstructed lines in Bacup, 2 miles 3·1 chains; total, 8 miles 7·7 chains.

There are numerous steep gradients and many curves, the steepest gradient being 1 in 15; the curves have, for the most part, a fairly large radius.

The track is laid to a gauge of 4 ft., with British standard rails weighing 100 lb. per yard. So far as possible, the rails are in 60 ft. lengths, each length fitted with three anchors secured to the rail flanges by Warner's patent anchor clips.

The rails are of high silicon steel, made to Sandberg's specification, the chemical constituents including: Carbon, ·53; silicon, ·292; sulphur, ·055; phosphorus, ·051; and manganese, ·83.

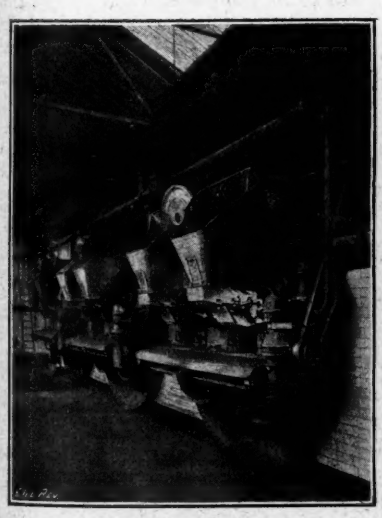
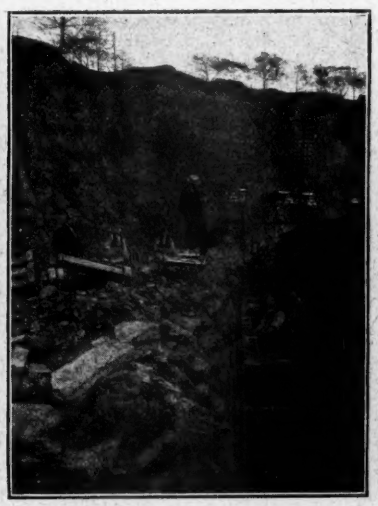
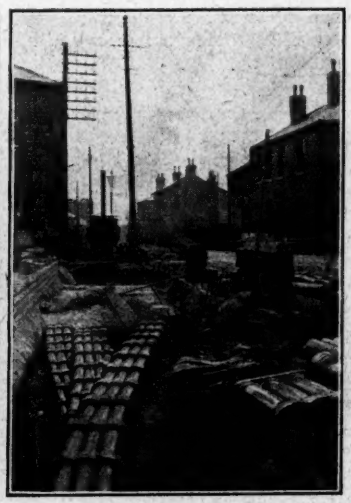


Fig. 2.—The Boiler House.





Figs. 3 and 4.—Laying the Mains.

The joints between rails are all welded by the Thermit process.

The points and crossings are of Hadfield's manganese steel, and the inner rails on the sharpest curves are fitted with Bulfin's patent renewable lip.

The joints, where welded, have no bonds, but at junctions between rails and points and crossings two solid copper pin

type bonds are employed on each rail, with supplementary long bonds over the points and crossings. Cross bonds are provided between rails at intervals of 20 yards, and between tracks at intervals of 70 yards.

On some portions of the route it was found that the old concrete bed was quite sound, and in these cases the old bed was re-used, elsewhere a new bed has been put down; the old granite setts have also been used where possible.

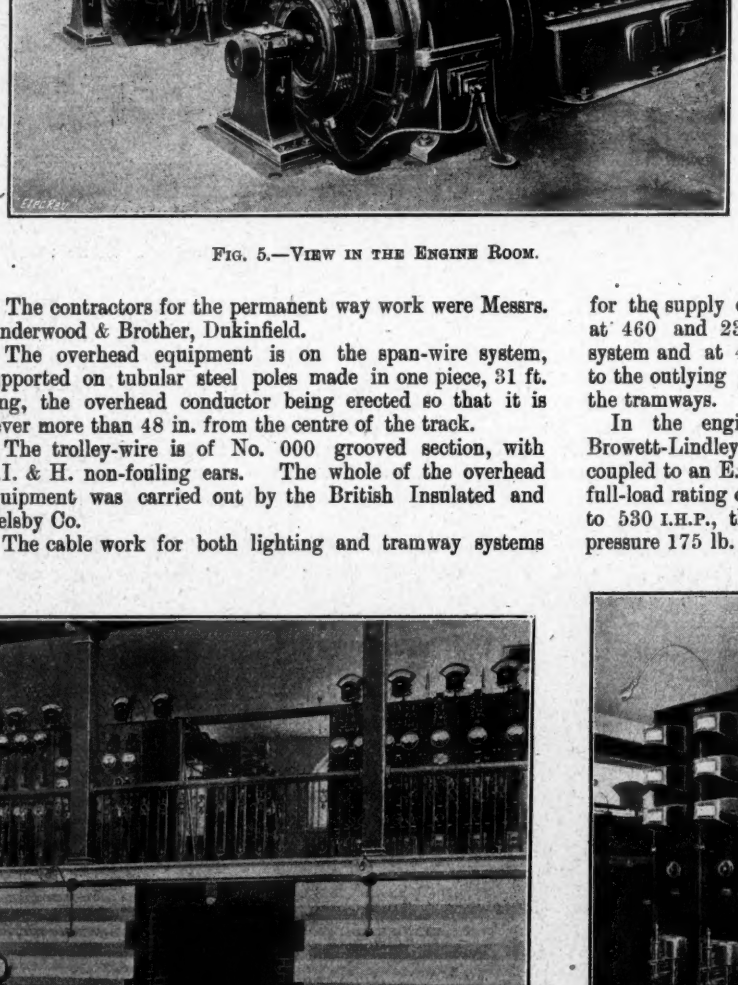


Fig. 5.—View in the Engine Room.

The contractors for the permanent way work were Messrs. Underwood & Brother, Dukinfield.

The overhead equipment is on the span-wire system, supported on tubular steel poles made in one piece, 31 ft. long, the overhead conductor being erected so that it is never more than 48 in. from the centre of the track.

The trolley-wire is of No. 000 grooved section, with B.I. & H. non-fouling ears. The whole of the overhead equipment was carried out by the British Insulated and Helsby Co.

The cable work for both lighting and tramway systems

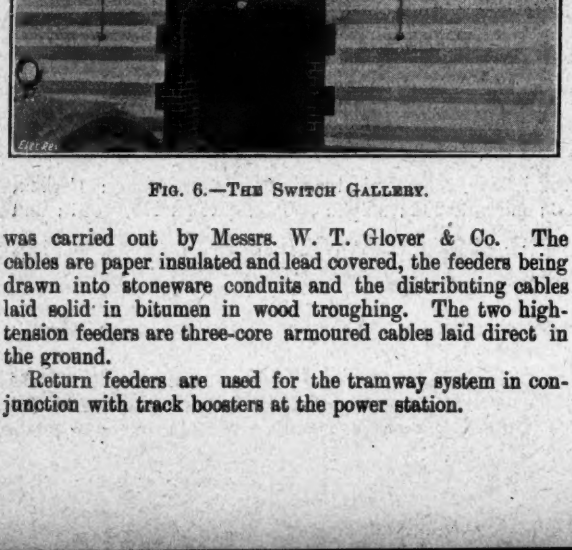


Fig. 6.—The Switch Gallery.

was carried out by Messrs. W. T. Glover & Co. The cables are paper insulated and lead covered, the feeders being drawn into stoneware conduits and the distributing cables laid solid in bitumen in wood troughing. The two high-tension feeders are three-core armoured cables laid direct in the ground.

Return feeders are used for the tramway system in conjunction with track boosters at the power station.

The feeder pillars were also supplied by Messrs. Glover; each section box is fitted with the usual switches for dividing the overhead line into half-mile sections and with a telephone by which communication can be held with the generating station. Telephones are also provided on each terminal pole on the different routes and at the car depôt.

The rolling stock comprises 16 cars, by the United Electric Car Co., each car being fitted with two Westinghouse motors, and arranged for the Raworth regenerative control. The cars are of the double-deck four-wheel type with canopy covers and have seating capacity for 51 passengers.

The hand brakes are fitted with the Peacock patent brake spindle, and mechanical track brakes of Spencer's latest pattern are also fitted; the regenerative control provides for electric braking.

The trolley poles are of the Brecknell, Munro & Rogers's swivelling type with specially low bases. The results in actual working with the regenerative control have been very satisfactory, the current consumption, as metered at the station, being only 1·1 units per car-mile.

The power station is a handsome brick building on the bank of the River Irwell at Hareholme, about a mile from the centre of Rawtenstall.

It comprises engine, boiler and switchrooms. Adjoining the switchroom is a block containing the offices and stores, with a basement beneath forming a battery room.

The station is designed and equipped for the supply of current for lighting and power purposes at 460 and 230 volts on the direct-current three-wire system and at 400 volts and 230 volts alternating current to the outlying parts of the borough, also at 500 volts for the tramways.

In the engine room are installed three three-crank Browett-Lindley enclosed type triple-expansion engines, each coupled to an E.C.C. generator. The engines have a normal full-load rating of 440 I.H.P., and are capable of working up to 530 I.H.P., the speed being 400 R.P.M. and the steam pressure 175 lb. per sq. in.

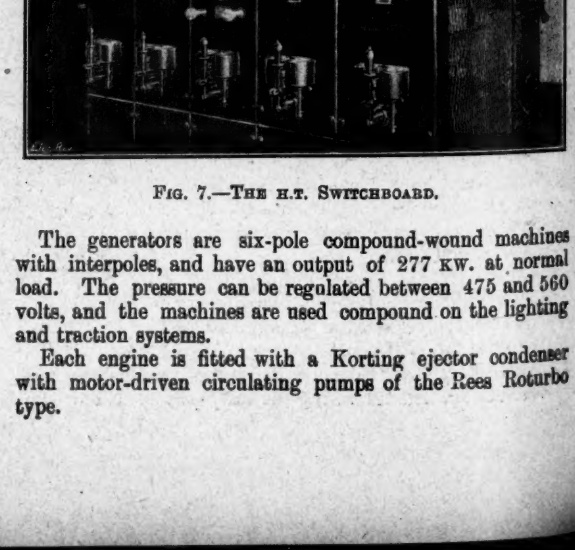


Fig. 7.—The H.T. Switchboard.

The generators are six-pole compound-wound machines with interpoles, and have an output of 277 KW. at normal load. The pressure can be regulated between 475 and 560 volts, and the machines are used compound on the lighting and traction systems.

Each engine is fitted with a Korting ejector condenser with motor-driven circulating pumps of the Rees Roturbo type.

Steam is supplied by three Yates & Thom Lancashire boilers, 30 ft. long × 8 ft. diameter, fitted with McPhail and Simpson superheaters and Bennis automatic stokers with compressed air furnaces. There are also installed a Green economiser with 192 tubes, two of Hall's compound feed pumps, each having a capacity of 3,000 gallons per hour, and an injector for 2,000 gallons per hour. The steam pipes, valves and other accessories in connection therewith were also supplied by Messrs. Yates & Thom. The auxiliary machinery comprises an inverted rotary converter set by the British Westinghouse Co., of 100 KW. output. This machine consists of two 100-KW. rotary converters mounted on one bed-plate, and arranged so that they can be coupled together by a clutch. The machine runs normally with the clutch in gear, one half being used as a direct-current motor on the traction system, and the other half as a double-current generator supplying direct current for the three-wire lighting system and three-phase alternating current, which is stepped up by static transformers to 3,000 volts for transmission to the outlying parts of the borough where three-phase transformers are installed for reducing the pressure to that required for the alternating-current distribution system. The middle wire of the direct-current system is connected to the neutral point of the step-up transformers, thus dispensing with the usual rotary balancing set.

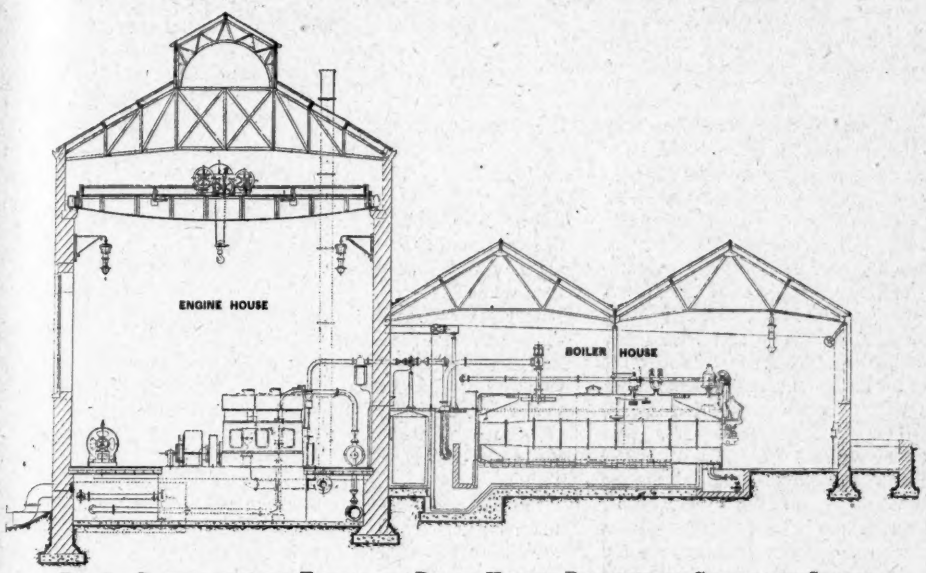


FIG. 8.—SECTION THROUGH ENGINE AND BOILER HOUSES, RAWTENSTALL GENERATING STATION.

After the tramway system is shut down only one-half of the machine is run, this acting as an inverted rotary taking current from the battery (which is then connected to the lighting system) and generating three-phase current for the A.C. supply.

In addition to the above, there is installed an automatic reversible booster by the Lancashire Dynamo Co., used in conjunction with the battery, two track boosters by Crompton & Co. for the tramway return feeders, and an ordinary E.C.C. three-wire balancing set.

The battery was supplied by the D.P. Battery Co., and comprises 240 cells with a discharge capacity of 56 amperes for 10 hours. This is used normally in conjunction with the booster on the traction system, but is transferred to the lighting system for the night load.

The L.T. switchboards were supplied by Messrs. Whipp and Bourne, of Castleton, and the H.T. switchgear by the B.T.-H. Co.

An overhead travelling crane with a capacity of 15 tons spans the engine room, and was supplied by Messrs. Thos. Larmuth & Son, of Salford.

The reconstruction and extensions of the permanent way, the electrical equipment, power house and all other work was carried out to the plans and specifications of Messrs. Lacey, Sillar and Leigh, of Westminster and Manchester.

The laying of the permanent way was supervised by Mr. James Johnson, the borough engineer, and the electrical work by Mr. C. L. E. Stewart, the engineer and manager.

THE ELECTRIC LIGHTING ACTS, 1882 TO 1909.

BY A CENTRAL STATION ENGINEER.

TWENTY-SEVEN years is no trifling span of time to those who have seen it pass from their working lives, but short, indeed, to have covered the creation and development of an art and industry whose ultimate influence on the life of civilised communities promises to be more far-reaching than that of any previous adaption of the forces of nature to the service of man.

In observing the growth of the electric supply industry in its relation to public opinion, it must be remembered that in spite of the novelty of the medium and methods, the general application of electrical energy to the production of light and power only constituted a new means of obtaining

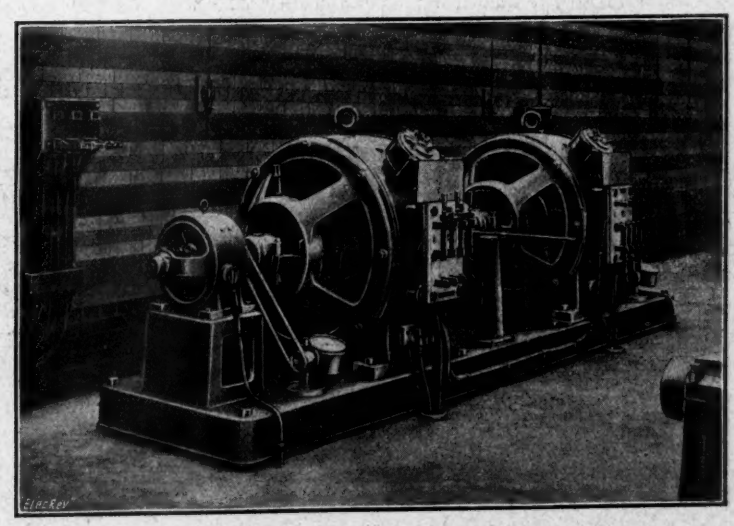


FIG. 9.—WESTINGHOUSE INVERTED ROTARY CONVERTER FOR A.C.-D.C. SUPPLY.

conveniences already in general use, and this immediately surrounded the new industry with an atmosphere of competition and no little opposition. Then, as even now to some extent, it suffered from friends who hoped too much for it, and from enemies who saw in its rivalry dangers which have hardly been realised and whose feelings have been reflected in the legal enactments which control the industry. Few in number and comparatively small in scope as these are in comparison with the present magnitude of the interests involved, their tendency has been restrictive, and for many years supply undertakings have urgently felt the need for wider powers and more complete legal support in their dealings with competitors and the electricity consuming public. After many delays a considerable measure of relief has been obtained by the passing of the Amendments Act of 1909, which from April of the coming year will modify existing electrical law in many directions, particularly in regard to the needs of public supply authorities; the consumer, actual or prospective, is favoured rather by the spirit than the letter of the Act, which in its provisions suggests a full if somewhat tardy recognition by Parliament of the importance of electricity supply as a utility which no section of the public should be avoidably deprived of.

Of the 27 sections of the Act, 12 are devoted to the larger issues of the industry, facilitating the establishment of works and bulk supplies, and making provision generally for removing any obstructions to the natural growth of the business; six sections deal with accountancy and finance and purely formal requirements of the measure, whilst the remaining nine are devoted to strengthening the position of the authority in relation to its consumers. Some of the latter items suggest the reflection that whilst electricity is subject to such active competition from other sources of light and power, its new rights should be asserted only with care and judgment, too much harm having already been done by approaching consumers in the spirit of the tax collector.

The establishment of generating stations is dealt with by Secs. 1, 2 and 3, which provide for the acquisition of sites within or without the area of supply, compulsorily if need be, by permission of the Board of Trade, and after due notice and advertisement; similarly the right may be obtained to break up roads, railways or tramways for the purpose of laying mains between the area of supply and outside generating stations without the consent of the authority controlling such roads if it can be shown that such consent is unreasonably withheld, these powers being qualified by Clauses 22 and 24, which respectively provide protection against nuisance and damage to public buildings and parks under control of the Commissioners of Works, and secure water and gas undertakings against compulsory deprivation of land required by them for the purposes of their undertaking. The vision conjured up by the latter clause, wherein the Board is solemnly restrained from allowing an electricity undertaking to acquire the gas company's property for the erection of a works, comes as a welcome relief after 10 tedious pages.

The important question of bulk supplies is dealt with in Clauses 4 and 5, which make it possible to obtain powers and carry out the necessary road work in the face of local opposition if the Board can be satisfied that such supply is needful and desirable. A liberal interpretation of these provisions should greatly assist electrical development in villages and the residential communities often found just beyond the boundaries of cities, and hitherto isolated electrically by the lack of power to supply and run mains rather than by distance.

By the use, where permissible, of overhead transmission, many new markets can be opened up, and some further impetus given to the healthful tendency, which already exists, for residential property of the better class to spread outward into the country.

Clause 5—allowing supply to be given to a railway, tramway or canal situated partly within and partly without the area—opens up interesting possibilities; presumably the supply company of a mining village in Wales might offer to the L. & N.W. Railway to run its system by electricity! Certainly, cases must arise where the prospects and value of an undertaking will be much enhanced by this provision. Of immediate interest to many station engineers is the permission contained in Sec. 6 to supply premises outside their area, subject to the consent of the local authority and any undertaker in whose territory such premises may be situated. It must be noted that such extensions will become part of the supplier's system for the purposes of the Electric Lighting Acts, and such supplies will be subject to the usual responsibilities.

On the fringe of most urban districts there are houses, and frequently factories, which are at present deprived of the advantages of electricity, although within a short distance of mains. Incidentally, the extensions which may be made under this clause will offer an inducement to manufacturers, of light goods at least, to seek positions beyond the boundaries of the town to which they are confined by the need of a convenient fuel supply; presumably when the electricity works are under municipal management it will be necessary for the engineer to so adjust his charges to "Outlander" consumers that too strong an inducement is not offered to pass beyond his rateable area.

Where a supply area adjoins, or is surrounded by the territory of power companies, the latter will not view with favour any attempt to connect up outside premises which may in the future development of their systems become desirable consumers; in such cases it should be possible to find some equitable arrangement whereby such consumers could be handed over after a term of years, or a royalty paid upon them by the supplier to the undertaking in whose area they are situated. Quite a considerable amount of business has been lost to suppliers and electrical manufacturers, owing to the inability of power companies to reach the limits of their areas within a reasonable time, and their not unnatural disinclination to allow the mains of other undertakings to enter their territory.

A case in point was recorded in the Electrical Review of December 17th, where the Lancs. Power Co. gave permission to the Oldham Corporation to supply a number of townships in the company's area.

In these leading clauses of the Act there is a satisfactory admission of the universal utility of a public electricity supply and an intention to make it equally available to all, irrespective of geographical situation, and further the tendency for generating centres to become reduced in number and increased in size whilst gravitating to positions physically suited for their operation will be strengthened by the provisions of this measure.

Problems of management receive attention, and some new and useful powers are given.

The maximum price, hitherto open to revision at intervals of seven years, can now be the subject of appeal by a representative body of consumers every five years (Clause 10). In (11) dealing with certification of meters, the "unfixing or disconnecting" of a certified meter no longer renders it uncertified as under the Clauses Act of 1899, the amendment merely providing that the meter shall cease to be a certified meter where any alteration has been made in it. The duties of the electrical inspector in respect of a disputed meter are now restricted to certifying it if correct, and also certifying the manner in which it is connected up—a not unimportant detail, in view of the confusion which is sometimes wrought by ignorant attempts to insert metallic lamp transformers in existing supply connections. Previous to this amendment, it devolved upon the inspector to determine the value of the supply given through disputed meters. This is presumably now left to supplier and consumer, and recent cases show the Courts to be undecided as to the justice of forcing a claim for payment on the evidence of a meter where such is widely-different to previous or anticipated registrations. Forty-eight hours' notice now becomes compulsory before a meter may be connected or disconnected, and it is of importance to note this in connection with changing meters for various reasons.

The stand-by supply difficulty is now provided for, and consumers may be called upon to pay a minimum sum per annum sufficient to cover standing and up-keep charges in proportion to the extent of their possible demand; this protection, which now becomes general, has been secured in special cases by clauses in local Acts.

Apparatus and wiring installations on hire or being paid for by instalments are fully protected against seizure by creditors of the hirer, provided that they are clearly marked

with the name of the authority to which they belong. In view of the fact that such apparatus may be removed by the owners, it would appear desirable to secure a landlord's sanction before fitting up any installation which involves structural alterations or much cutting and fixing to the fabric of a building, as presumably the owners when removing it would be obliged to make good any damage to property.

Clause 17 makes it incumbent upon consumers to give 24 hours' notice before removing, failing which they become liable for energy registered up to the next usual meter reading period, or at least until the next occupier takes up the supply; the effect of this provision is to be duly intimated to consumers upon all demand notes. It hardly need be pointed out that, in practice, such notice is often indirectly given by the consumer calling for a supply at a new address in the same area; in such cases the organisation of the undertaking should be sufficient to realise that the premises have been vacated and the necessary steps can be taken to avoid giving annoyance to the consumer by putting into effect powers which are only intended to protect the undertaking.

In Clause 18 power is given to cut off or refuse to supply any person at all of his premises, if payment is in arrear for any of them, save in the case of *bona fide* disputes; presumably this can, in any case, be done where the several premises are served by agreement under the same name or trading title, but too much insistence upon the principle of electrically combining distinct premises under common ownership is apt to lead the consumer to expect his combined demand and consumption to be taken into account when fixing rates, a principle which may often be contrary to the interests of the supplier, and one which engineers often have to refute.

Clause 19 removes the necessity for stamping consumers' agreements, by rating electricity as goods or merchandise, contracts for the sale of which are exempt by the provisions of the Stamp Act of 1891. Some undertakings already neglect to stamp ordinary agreements in view of the rarity of any occasion to take them before the Courts; it seems, however, possible that they thereby render themselves liable to action by the Inland Revenue authorities for this neglect, and, even under the new Act, where the agreement provides for a minimum charge, or for fixed sums to be paid at intervals, as in a rental per KW. system of charging, it is not clear that an *ad valorem* stamp can be legally dispensed with.

The treatment of electrical energy as "goods or merchandise" in the clause in question suggests that certain other facilities might be logically claimed on the same basis, for example, the right to lay cables across private lands where a recognised public right of way already exists; inasmuch as it is permitted to convey ordinary goods over such lands, it should not be unreasonable to demand the right to lay or erect lines for the conveyance of electricity, which is becoming as indispensable as the commodities generally transported by road.

The necessity for stamping "hiring or deferred payment" agreements for apparatus and wiring remains unchanged by this amendment.

Clause 23 protects the undertaker against future attempts of competitors, but allows companies or persons to supply electricity, providing that such supply does not constitute their principal business. Framed, possibly, to protect those who already supply their neighbours from their own private plants, it has the disadvantage that it remains competent for the owner of generating machinery to dump his surplus units at any price he deems it worth while to accept. Most engineers are familiar with this class of competition, arising, as it often does, from some business established in a large block of buildings, and causing a considerable loss to the supply authority by providing light and power to the various occupiers at prices which are only remunerative because the vendors are disposing of what is, to some extent, a by-product of their main business.

Similarly, it would appear possible for a gas or hydraulic power company to provide and work an electric plant by arrangement with any consumer who wished for electricity. One instance, at least, has already arisen where a gas company has provided and maintained a plant for lighting a public building by means of electricity, the prime mover being, naturally, the gas which the consumer prefers to see burnt in the cylinder of an engine rather than in his premises.

Generally, the provisions of the Act are of real value to the industry, and those engineers who are not already familiar with it by virtue of having assisted in its production, may peruse its clauses with advantage and reflect upon the expenditure of effort and patience which has slowly crystallised out into its formal pages.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Socialistic Bogey.

For your views on all engineering questions I have the utmost respect. I have diffidence in criticising anything carrying the authority which attaches to a leader in the ELECTRICAL REVIEW.

But your recent incursions into the realms of party politics, and even of religion, call for a respectful protest, more particularly as your reference to Socialism was certainly calculated to give offence to that considerable section of your readers who are Socialists.

Of necessity, the treatment which can be accorded to such a subject by an engineering journal as such, is so cursory as to be totally unproductive and even misleading, and the only result which can accrue is that all parties are distressed by the inadequate presentation of their case.

To attempt in the space of a letter to refute the contentions of your leader would be almost as futile as your attempt to erect and demolish a dummy Socialism in a couple of columns; but if you are willing that the other side shall not remain unheard, and are prepared to accord space, it will be a pleasure to me to make a short contribution in support of my economic convictions.

As, however, my complaint is directed against your introduction of such topics rather than against your attitude on this particular subject, I do not press this offer upon you.

Le Caporal.

[We are sorry that we have given annoyance to our correspondent, whose courtesy disarms rejoinder. We fear that to open our columns to the discussion suggested would result in the absorption of a vast amount of space—without convincing either party.—EDS. E.R.]

Auto-Transformer Design.

When a technical reviewer has to write an unfavourable critique and comment on glaring errors, he does so with the consciousness that his remarks will not meet with the approval of the author. Having finished his work, it remains for the Editor to decide whether or not his critique is a just and competent one before publishing it, and it is to be presumed that the Editors of the ELECTRICAL REVIEW discharged their duties in dealing with Mr. Avery's book, "Auto-Transformer Design."

The writer freely concedes that what he does not know would fill a larger book than the one under discussion, but it is without any vanity that he points out that what he *does know* enabled him to see the defects in it.

The reviewer does not wish to defend his critique, as the points raised in it must be very well known to many who have considerably less technical experience than he has (15 years) of the various phases of transformer work.

Now Mr. Avery can have had no knowledge whatever of the reviewer other than what may have been supplied him by a certain interested third party, and the writer having carefully read through Mr. Avery's book (he might say he has read two of his works) unhesitatingly acquits him of the charge of real authorship of the letter appearing in last week's ELECTRICAL REVIEW.

Such remarks as Mr. Avery is made to indulge in cannot in the least contribute to an understanding of the rights or wrongs of transformer design. There are plenty of indifferent transformers in every-day use, but the industry would not have advanced so far if anyone had not thought fit to point out how certain features might be improved upon.'

The reviewer has much pleasure in returning Mr. Avery's good wishes for the coming festive season.

The Writer of the Review.

Cable-Fault Localisation.

With reference to Mr. Raymond-Barker's articles in your paper on his Calculator Board, in which he describes a method of locating defects in submarine cables re-devised some years ago by myself, I should like to point out the following facts which, I think, will be of interest, and perhaps helpful, to those who use the test and are unable to account for occasional inaccuracies such as Mr. Raymond-Barker cites in his article in your issue of November 19th, 1909.

In that article he mentions a test that he took by the method under consideration, which gave a result 19 ohms higher than the correct resistance up to the defect. Mr. Raymond-Barker's explanation of the cause of this error cannot, I think, be correct. He supposes the extra resistance to be located between the copper exposure and the iron wire acting as earth connection to the artificial fault. The extra resistance cannot be here, as in that case the apparent resistance up to the fault given by this test would be too small rather than too large.

A possible explanation of the error is that there was a constant resistance situated at the actual exposure, due to a deposit of CuCl, or otherwise, between the conductor and cable sheathing, which did not vary in the same relation as the artificial exposure. This, however, is an unlikely explanation, as the Kennelly and other tests show that the fault was behaving in a normal manner.

The writer is of the opinion that the error was due to an earth current assisting the testing current, which thus did not allow the conditions of "other things being equal" to be fulfilled.

It can easily be shown that with the earth current assisting the testing current, and a battery of negligible resistance, the current passing through the balancing arm of the bridge will never be greater than that indicated by the applied E.M.F. flowing through it in a direct circuit. To take Mr. Raymond-Barker's results of Test 5, tabulated on page 755 of your issue, it will be noticed that the two currents for 20 and five cells are in the ratio of $13/4{\cdot}1 = 3{\cdot}2$, whereas with no E.C. as in Test No. 2, with other conditions apparently identical, we have ratios of $11{\cdot}6/2{\cdot}8 = 4{\cdot}1$. We may, therefore, take 11·6 and 2·8 M.A. as the maximum values of the currents passing through the Art. Exp. in Test 5, whereas 13·1 and 4·1 M.A., respectively, pass through the actual exposure. It is evident from the above figures, in fact, it is always the case, that the lower the applied E.M.F. the greater the effect of the E.C. in altering the value of the current passing through the cable. Taking these figures as representative of the proportional amount of current through the actual and artificial exposures respectively, we note that with the higher current the resistance of the cable exposure will be less than it should be by a certain amount proportional approximately to $\sqrt{13/11{\cdot}6} = 1{\cdot}03$; and that with the lower current the deficit in resistance will be proportional to $\sqrt{4{\cdot}1/2{\cdot}8} = 1{\cdot}23$. This means that the deficit in the inserted resistance on the artificial exposure side will be considerably less with the lower current than with the higher. This makes it probable that, under the conditions as above stated, an artificial exposure, actually much larger than the cable exposure, will appear to balance the latter and thus give erroneous results.

This theory seems to be borne out in Tests 4 and 5 above referred to; for it seems probable that an erroneous result would have been obtained in both cases, even when the exposures were apparently correctly balanced. It will be noticed in Test 5 that with 1 in. exposure a balancing resistance of 1,248 ohms was obtained with indications that the exposure was too small. It is known that the test with the highest current gives the nearest correct resistance up to the fault; and if the artificial exposure is altered in the direction indicated, it follows that the resistance inserted to balance it will be greater than this amount. As the true resistance was 1,240 ohms, it is thus probable that there would be a considerable error in this case. It seems likely that a similar error in the reverse direction would be the final result of Test 4.

As to the remedy—a simple way would be to equalise the potentials in both circuits by applying an E.M.F. to the galvanometer circuit, in some such way as indicated by Mr. Winkfield and mentioned by Mr. Raymond-Barker. A second way would be to use reversed currents and take the mean of the results; this might not be applicable to small exposures. The simplest way of all would, perhaps, be to reverse the positions of the galvanometer and battery so that the current passes in series through the actual and artificial exposures; care, of course, being taken that the current passes through the actual and artificial exposures in the same direction. The only other thing to guard against with these connections would be to be careful that too large a current did not flow through the galvanometer circuit; and for this reason it would be advisable to reduce the current flowing through the galvanometer to within scale limits, by the insertion of resistance in series with the galvanometer rather than by a shunt upon it.

A rough determination as to whether this error is likely to be present can be made when a milliammeter is available; for if the current (with batteries of low internal resistance) passing into the cable is proportional to the applied E.M.F., then the E.M.F. due to earth currents must be negligible.

I should like to mention that I was not aware that this test had been previously suggested until my attention was called to Mr. Raymond-Barker's article.

It is hoped that the above suggestions may make the test uniformly reliable through a very large range of conditions.

E. S. Heurtley.

Montreal, *December 11th*, 1909.

[Mr. Raymond-Barker is, we believe, at sea on a cable-repairing expedition, and will, therefore, be unable to reply for some time.—Eds. E.R.]

The Present Aspect of Electric Lighting.

The paper by Messrs. H. W. Handcock and A. H. Dykes opened up many new and interesting points, but the one which I found a difficulty in appreciating was the information given in Appendix A ("Typical Gas Consumers' Accounts"), for at first sight I came to the conclusion that consumers did not pay as much for gas as for electricity, and that the examples could not represent an average. In order to obtain some information on this point, I issued forms containing a series of questions to 200 of my firm's employés, and as they consist of mechanics and labourers, the results should represent a fair average for the artisan class. I was a little disappointed, for out of the 200 forms only 51 were returned; the majority could not ascertain how much they spent, while the others were using "penny-in-the-slot meters," and did not know the total amount which passed the opening.

Of the 51 who supplied information, they represented an average over the whole of the metropolitan area, and some extended to Ealing, Wimbledon and Enfield, &c. I give herewith the tabulated results for the quarter ending Christmas, 1908 :—

Houses or consumers	51	
No. of rooms, not counting bath room and scullery	190	
„ gas jets	225	
„ electric lamps	31	
„ gas cookers	29	
„ oil lamps	8	rooms

Total amount paid for quarter ending Christmas, 1909 :—

Gas lighting and cooking	£38	9	10
Electric light	3	4	5
Oil	1	4	4

One consumer used oil for lighting and gas for cooking, and his bill per quarter for gas amounts to 5s. 11d., which sum is, so far as I can ascertain, a fair one, but rather under the average.

Taking as a basis that 6s. per quarter is a fair rate for gas cookers, the foregoing works out as follows ;—

Gas light per quarter	2s. 8d. per burner.
Electric lighting	2s. 1d. per lamp.
Oil for eight rooms	3s. per room.

In order to ascertain if 6s. was a fair average for a gas stove, I separated the 28 gas-stove consumers from the others, and still deducting the 6s. from each, the lighting average works out at 3s. 1d., so that a mean average would be somewhere between 2s. 8s. and 3s. 1d. (say, 2s. 10d.) per quarter per burner for gas lighting, a sum which far exceeded my anticipation, while with electric light the average as before given is only 2s. 1d. per lamp per quarter.

Those who are keenly interested in tariffs may find these results useful, and this is my apology for taking up so much of your space.

W. R. Rawlings.

London, S.W.

Accumulators for Central Stations.

Our attention has been called to a note headed "Battery Contracts" in "Business Notes" of your last issue, in which, among many others, one for Manchester Corporation is mentioned. As it is possible that your readers may confuse this with the large battery which, as is well known, is being put down by the Manchester Corporation electricity department, we wish to state that the battery referred to in the note is for Manchester Corporation water-works department, and has only a capacity of about 60 KW. for 1 hour. The electricity works battery, which is the largest single battery in this country, will be a Tudor battery, and will have a capacity of about 3,200 KW. for 1 hour.

Tudor Accumulator Co., Ltd.

London, S.W., *December 20th*, 1909.

The Fetish of the Steady Job.

I am loth to prolong the discussion on this matter, and probably it would serve no useful purpose to do so ; indeed, I feel it to be almost unnecessary, as I can scarcely imagine that any of your readers will have had the patience to read through the tiresome tirade of your contributor, "R. E. N."

I hardly think that he is justified in seemingly dedicating his shallow and ill-considered principles to myself, since, as far as I can follow it, his rambling and disconnected article has no real bearing whatsoever on the main points which I raised in my contribution to the ELECTRICAL REVIEW on November 19th.

A. P. C.

London, E.C., *December 20th*, 1909.

Protection of Tramway Trolley Standards.

Your correspondent "Nemo" raises an important point when he draws attention to the fact that the red lamp does not in any way prevent a passenger from receiving a shock. There are, in fact, several serious drawbacks connected with its use :—

1. The filaments are liable to break, and such breakage cannot be detected by a casual inspection.

2. The lighting-up of the lamps may remain for some time unnoticed by the driver, who already has quite as much as he can do in other directions.

3. Perhaps the most serious objection of all is that a high resistance fault may allow the trolley standard to be raised to a potential of 300, or even 400, volts above the earth without the lamps lighting sufficiently to be noticed.

As to the query "Then why do the Board of Trade sanction lamps with an audible signal ?" The answer seems to be that the addition of such an audible signal largely removes objections (1) and (2), though not objection (3), and further, that, contrary to the commonly accepted idea, the Board of Trade are anxious to avoid running tramway undertakings into greater expense as regards altering existing equipments than is absolutely necessary. They, however, fully recognise the disadvantages of the arrangement, and although for these reasons it is at present *sanctioned*, what they *recommend* is that the standard should be normally connected to earth through a low resistance.

It was for this reason that Mr. A. H. Pott introduced the device which is now extensively used on his system (the Metropolitan Tramways), which arrangement overcomes all three of the disadvantages enumerated above :—

1. In place of the fragile lamp filament, there is a continuous wire resistance and "buzzer." Moreover, a test key is provided, by means of which it can be at once ascertained whether the whole is in working order.

2. A distinctive audible signal is given, which cannot possibly be overlooked or mistaken.

3. It is impossible for the standard to rise above earth's potential without the signal being given.

This system is, we believe, the only one possessing these features.

With reference to your editorial note, the solution there proposed—*i.e.*, to connect the trolley standard permanently to earth through an indicator—has been extensively tried, but it has in practice proved itself to be too drastic a remedy, and several serious shut-downs have been occasioned by it.

Everett, Edgcumbe & Co., Ltd.

Hendon, *December 20th*, 1909.

[We are aware that our proposed remedy is drastic ; but the first consideration must always be the safety of passengers, shut-down or no shut-down. If an attendant in the power station were in danger of losing his life, would anyone hesitate to shut down the whole system ?—EDS. E.R.]

Some Points in Relation to Arc Lamps.

With regard to the above-named article appearing in your last week's issue, the writer communicating it must have had very little practical experience concerning hire-of-arc-lamp schemes, for the veriest trimmer employed on such a scheme would know that the figures he quotes are ridiculous.

1. According to the figures given, each lamp is assumed to take 600 watts. The actual wattage of the average "Flame" arc lamp hired to consumers is 400 watts or less.

2. The assumed figure of £6 per lamp is more than 60 per cent. higher than the average market figure, as also are the figures given for the transformer.

3. The assumed life of arc lamps on hire is given as three years. Two years is none too long a period to allow.

4. No mention is made of the carbon cost, which is a most important item in a "Flame" arc lamp hire scheme.

I could point the writer of the said article to a "Flame" arc lamp scheme, the charges for which are £8 4s. per year per lamp, including current, carbons, trimming, maintenance, and the hire of the lamp itself, for a maximum period of 800 hours per year, which pays its way on a basis of 3d. per unit for current consumed.

It seems a great pity that your valuable paper should be the publishing medium for an article quoting such misleading and inaccurate information to the discouragement of progressive supply undertakings.

H. H. Holmes,
Sales Manager.

Borough of St. Marylebone Electric Supply.
December 20th, 1909.

With reference to the communicated article in last week's issue of the ELECTRICAL REVIEW, as manufacturers of flame lamps we entirely disagree with most of the writer's statements and conclusions.

He states that the cost of a first-class flame lamp and transformer is £8 to £8 10s., but this is certainly not the net trade price for even a lamp of such handsome appearance and high reputation as our "Beacon" flame lamp, let alone the fact that there are many cheaper and cheaper-looking flame lamps on the market.

With reference to preferential rates, which he states are allowed by numerous supply companies, we think he entirely

overlooks the value of arc lighting, when well done, from the point of view of advertising the use of electricity, as, despite all the claims of the gas industry, there is no form of lighting which can compare in brilliance or effective illumination with that given by flame arc lamps.

The third point to which we must take exception is the cost of the current, which is apparently based on a 600-watt lamp. This is a totally unnecessary consumption, and a brilliant flame effect can be obtained with a consumption of 350 watts or less with suitable lamps and carbons.

The writer also states that it is necessary to call every morning to trim the lamps, whereas in the case of a lamp burning 12 to 13 hours this would, of course, be quite unnecessary.

We think, therefore, that your readers will agree that all the disadvantages raised by your contributor are practically non-existent, and that there is every reason to think that the installation of flame lamps by the supply companies is bound to stimulate their demand and increase the output of electricity.

The Gilbert Arc Lamp Co., Ltd.
J. HECHT, *Director.*

Chingford, *December 21st*, 1909.

[We understood our contributor to criticise the rates offered to consumers, on purely financial grounds; his conclusions are, of course, open to criticism, but we do not think his article was intended to be hostile to the use of arc lamps.—EDS. E.R.]

THE INSTITUTION AND THE ELECTRICAL INDUSTRY.

WE have received from Mr. E. Garcke copies of the following letters that have passed between himself and the secretary of the Institution of Electrical Engineers, regarding a recent discussion at the Institution:—

December 10th, 1909.

P. F. Rowell, Esq., *Secretary*,
Institution of Electrical Engineers,
92, Victoria Street, S.W.

DEAR SIR,—I am sorry that at the Institution meeting last night the President disparaged the statement I made by describing it as "politics," and that he warned other speakers not to discuss the paper before the meeting on the same lines. I maintain that it was impossible to express disagreement with the conclusions of the paper without touching on matters which might be called politics. His ruling was equivalent to saying that disagreement must not be expressed with the conclusions suggested by the paper.

Some statements were made by Mr. Mordey, Past-President, which, in the general interests of the industry, should, I think, be further explained. I understood him to say that it was not the province of the Institution to undertake the protection of the industry in legislative and commercial matters. At the same time, in reply to my statement that the Institution had neglected to deal properly with the Electric Lighting Bill of this year, he said that a special Committee had been appointed which had made representations to the Board of Trade on the subject, but that it was the duty of the Institution to look at these matters not from the point of view of the industry alone, or of any particular section of it, but also from the point of view of the consumers and the general interests of the community.

If this is the accepted view of the province of the Institution in regard to these matters, then I can readily understand that the special Committee would allow the draft audit clause and the draft clauses dealing with competition between local authorities and companies in the Bill to pass, for inactivity would, in that case, be the best policy for the Institution.

But as representing very important and considerable interests in the industry, and I am aware that there are other and no doubt equally representative members who agree with me, I say unhesitatingly that, in my opinion, this view of the province of the Institution ought not to prevail with the Institution. Such exalted functions pertain to Legislative and Government Departments.

As matters stand at present, a large proportion of electrical men are under the impression that the Institution recognises and undertakes the responsibility of safeguarding the interests of the electrical industry in the battle of life.

We ought not to be left in any doubt upon the subject, and in my view the province of the Institution in legislative and industrial matters should be settled and definitely stated.

So long as there is any doubt about the matter it is impossible to make other arrangements for the performance of these necessary duties. The position of the electrical industry in its legislative and industrial aspects is so unsatisfactory, and the attitude of the Institution in regard to these questions so uncertain, that with due regard to the large interests involved, such uncertainty ought not to continue, and I trust, as I stated last night, that the President and the Council will give the matter their early and serious consideration.

I am, dear Sir, yours faithfully,
(Signed) E. GARCKE.

P.S.—The reporter of the Institution asked me to send a copy of the statement I made—this was sent you yesterday.

The Institution of Electrical Engineers,
92, Victoria Street, London, S.W.
December 17th, 1909.

E. Garcke, Esq.,
Electrical Federation Offices,
Kingsway, W.C.

Dear Sir,—I am instructed to inform you that your letter of December 10th was read to the Council at the meeting held yesterday, and that it will receive consideration.

I am, yours faithfully,
(Signed) P. F. ROWELL, *Secretary.*

THE PHYSICAL SOCIETY'S EXHIBITION.

IN the following notes we give some particulars of interesting apparatus shown at the recent exhibition of the Physical Society of London, at the Imperial College of Science, South Kensington.

Harry W. Cox & Co., Ltd.

Amongst the apparatus shown by this firm was a new form of the Cox mercury-jet interrupter, which we illustrate; it includes several important improvements, of which the chief are:—(*a*) Any current up to 30 amperes may be passed without injury to the break, while the regulation is so complete that the current passing through the coil can be varied from practically zero to the maximum, with no other control; (*b*) By an ingenious mechanism, a large resistance, approximately 200 ohms, is put into circuit at the moment the current is "made," and is gradually taken out, so that when the current is "broken" the resistance in circuit is practically nil; consequently a minimum amount of inverse current is induced in the induction coil. This is a most important factor in X-ray work. The inverse current usually produced by mercury-jet breaks blackens and destroys the focus tube, and also causes blurring of the image on the plate. In the present case the desired effect is obtained by the simple device explained in the accompanying diagrams, figs. 1 and 2.

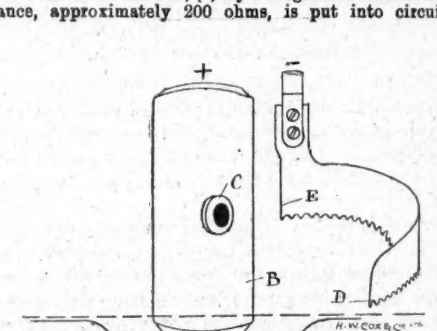


FIG. 1.—ELEVATION OF 1910 "ANTI-INVERSE" INTERRUPTER.

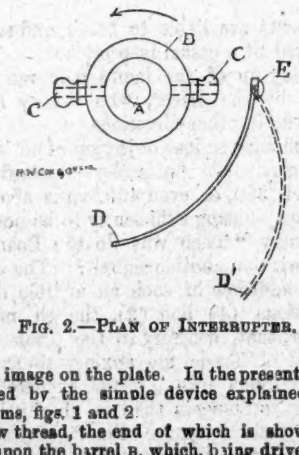


FIG. 2.—PLAN OF INTERRUPTER.

A quick screw thread, the end of which is shown at A, fig. 1, is cut internally upon the barrel B, which, being driven by an electric motor, pumps up mercury from the reservoir and discharges it from

two nozzles C. The mercury stream during part of its revolution strikes against the curved blade, making contact at the point D and breaking at E. By swinging the blade the arc of contact is increased or decreased, and the time allowed the current to grow in the primary circuit of the coil is varied at will. The nozzle is shaped in such a manner that shortly after leaving it the mercury

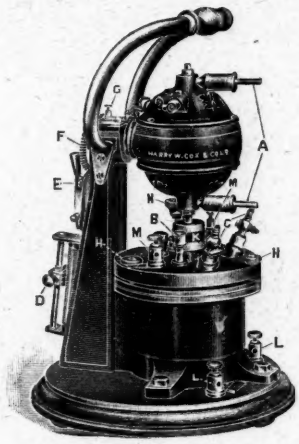


Fig. 3.—Cox 1910 Jet Interrupter, Complete.

stream begins to split up and to form nodes or constricted portions having a high resistance; consequently, at D or D^1 the resistance in circuit is very considerable, and this resistance is gradually removed until at the break at E the only resistance is that of ¼ in. of solid mercury jet, which is practically nil. Fig. 2 is a horizontal section of the apparatus, and fig. 3 shows the device complete.

One of these new interrupters was shown working a 14-in. "Instantaneous" coil (fig. 4), giving a flame spark at full contact. Another was shown interrupting the current to a metal-filament lamp, instead of to the primary of an induction coil. It is interesting to note that this is a much more delicate test for the evenness and regularity of an interrupter than the lighting-up of an X-ray tube. Every interrupter made by the firm is tested by this method before being sent out. The slightest irregularity of contact would be shown by a flickering of the lamp, especially when it was run at a dull red. The steadiness of the light showed the regularity of contact, due to the fact that each particle of mercury strikes the blade approximately at right angles at all points.

The induction coils exhibited were of an improved design adopted by the firm in consequence of their experience of two years with coils giving a very heavy discharge, which have begun to be designed since the introduction of instantaneous radiography. The firm build all types of induction coils, and the two essential types were shown, namely, "multisection" coils, and "two-section." The latter have long been a speciality of the firm, who have brought the art of winding it to a high state of perfection. They claim that though it requires more careful winding and insulating, and, therefore, is rather more expensive to make than the "multisection" type, yet the increased output for the same

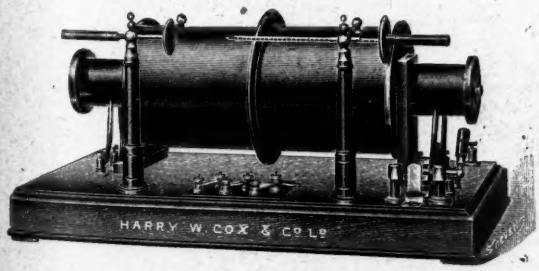


Fig. 4.—14-in. Variable Primary "Instantaneous" Coil.

primary current makes this type most suitable for X-ray and vacuum-tube work. Their endurance is shown by the fact that their makers can guarantee all their coils for five years. The "multisection" type is used when large condensers have to be charged, *e.g.*, for wireless telegraph work. A two-section coil was shown which could take a radiogram of the chest in half a second, pass 150 milliamperes through the spark, and take a primary current of 90 amperes. The firm make a speciality of portable coils, and coils for hot climates, and a 12-in. portable coil was shown for work on the Indian plains, which is tested after being kept for 10 hours in a damp atmosphere of 130° F.

An improved form of medical high-frequency machine was shown. This machine is usually worked from the same induction coil that lights the X-ray tube, and it has been found that the high-tension oscillating current from the primary circuit of the high-frequency transformer travels back to the secondary circuit of the induction coil; as the maximum pressure of the oscillatory current is considerably greater than that of the uni-directional coil current, it tends to destroy the insulation and break down the secondary circuit of the coil, and many breakdowns have been traced to this cause. To remedy this, the oscillating currents should be prevented from reaching the coil, and a new device for effecting this was shown, consisting of a pair of "high-frequency protection coils." These are simply large inductance coils wound in sections, and very carefully insulated, which are clipped in the high-frequency terminals. The effect of the large inductance is to absorb the high-frequency oscillations, while allowing the direct current from the coil to pass unimpeded. There was also shown a Tesla coil, and a neatly designed wireless telegraph receiving apparatus.

The firm have recently established a glass-blowing department, and examples of their work were on the stand, including an X-ray tube which had been fitted with a new glass bulb and re exhausted.

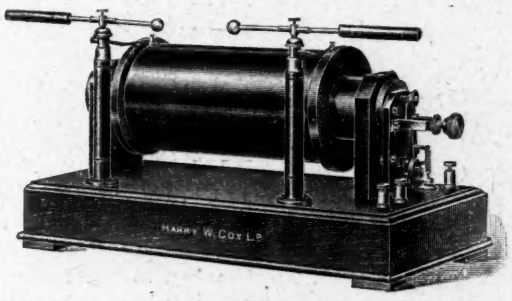


Fig. 5.—Wireless Telegraph Coil, with Cox Patent Break.

A considerable amount of expense is thus saved to X-ray workers, who can have their old tubes, hitherto useless, reblown and made equal to new. All the apparatus exhibited, with the exception of three X-ray tubes, was of English design, make and materials.

Owing to the illness of Mr. Cox, the business is being carried on by Mr. H. E. Donnithorne, A.M.I.E.E., and Mr. V. H. Donnithorne, who were responsible for the design of all the apparatus shown.

Everett, Edgcumbe & Co., Ltd.

A large exhibit was prepared by Messrs. Everett, Edgcumbe & Co. including several novel features. The "Universal" pattern Trotter photometer was shown arranged for the measurement of daylight illumination, the attachment for this purpose consisting of a tube 10 in. high, with a side tube for inspection as shown (fig. 6). The illumination measured, therefore, is that of the sky at the zenith. Graduated stops are provided, marked with the ratio of their area to that of a hemisphere of 10 in. radius. After taking a reading out

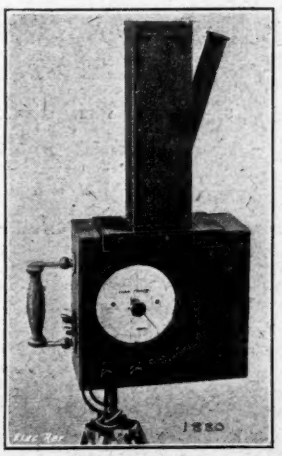


Fig. 6.—Daylight Illumination Photometer.

of doors with a suitable stop, the attachment is removed, and the daylight illumination inside a building can be measured in the ordinary way, the ratio between the results being independent of all the variable factors concerned, such as the season, the weather, the condition of the lamp or battery, &c. For example, the daylight illumination in the House of Commons is 0·0009, and in the British Museum reading room 0·007, of what it would be if the roof and all other obstructions to light were removed.

A 10-ft. photometer bench for laboratory and central-station use was exhibited, with an adjustable screen photometer head capable of use as a flicker or a comparison photometer (fig. 7). A special feature of the head is the fact that the adjustment of illumination can be made by altering the angle of incidence of light on one of the two screens. The advantage of this is that instead of its being necessary to move a heavy carriage with a standard lamp, &c., both lights can be fixed and the entire adjustment made on the photometer head itself. This is particularly useful when dealing with flame standards; it is also much easier to obtain a balance by this means than with the comparatively slowly moving lamp carriage. A further advantage possessed by this arrangement is that it affords a ready means of reducing the illumination from one of the lamps, so

that it is easy to test high-candle-power lamps, such as arcs and so forth, in a comparatively small photometer room. For comparing a number of almost similar lamps, where it is merely wished to know by what percentage they are above or below a given value, it also affords an extremely rapid means.

A portable direct-reading lamp photometer was shown, consisting of a wooden case measuring 11½ × 18½ × 4¾ in., and weighing only 12 lb. It has been designed for the rapid testing of

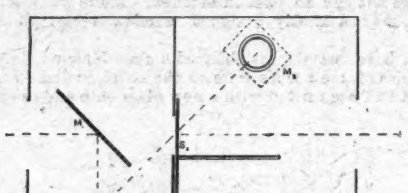


Fig. 7.—Section of Adjustable-Screen Photometer Head.

metal-filament and other high-efficiency lamps. The scale is direct reading, and is almost evenly divided; it has a very extended range, and can be used for taking measurements up to 100-c.p., or for testing arc and other lamps which can be placed in the photometer itself. The photometer can be checked on an ordinary photometer bench against either an electric or a flame standard.

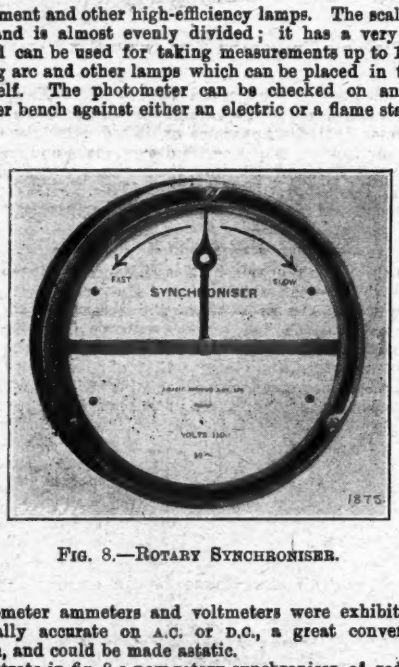


Fig. 8.—Rotary Synchroniser.

Dynamometer ammeters and voltmeters were exhibited, which were equally accurate on A.C. or D.C., a great convenience in calibration, and could be made astatic.

We illustrate in fig. 8 a new rotary synchroniser, of reduced size compared with previous patterns, and greater sensitiveness, in spite of the smaller diameter of dial, since one complete cycle difference in frequency corresponds to one revolution instead of to half a revolution, as was formerly the case. There are in this instrument no

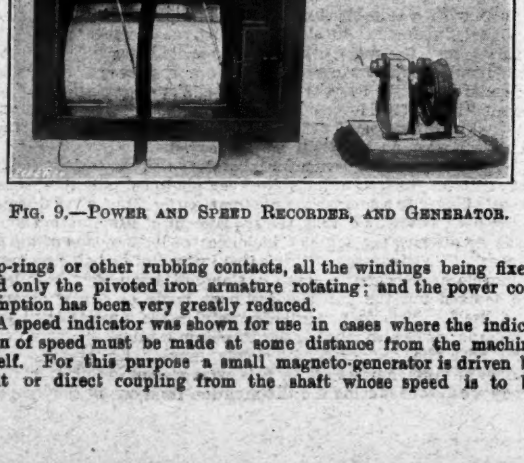


Fig. 9.—Power and Speed Recorder, and Generator.

slip-rings or other rubbing contacts, all the windings being fixed, and only the pivoted iron armature rotating; and the power consumption has been very greatly reduced.

A speed indicator was shown for use in cases where the indication of speed must be made at some distance from the machine itself. For this purpose a small magneto-generator is driven by belt or direct coupling from the shaft whose speed is to be measured, and is connected by two small wires to the indicator, which can be fixed in any convenient position. The scale of the latter is evenly divided, and can take any required form. The indicator is dead beat, and the speed is instantaneouly indicated.

Several indicators can be fitted at different points, a water-tight one being installed on the bridge of a ship.

When it is wished to record the speed on a paper chart, a recorder of the ordinary pattern with either 24-hour or weekly charts is provided. The accompanying illustration, fig. 9, shows such an instrument, arranged to record simultaneously power and speed.

Our last illustration shows the Trotter accelerometer, a simple little combined gradient and acceleration meter, devised by Mr. A. P. Trotter in 1904. It consists of a specially-shaped glass tube

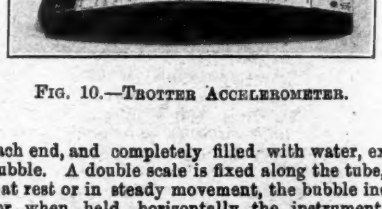


Fig. 10.—Trotter Accelerometer.

sealed at each end, and completely filled with water, except for a small air bubble. A double scale is fixed along the tube, and when the tube is at rest or in steady movement, the bubble indicates the gradient, or when held horizontally the instrument indicates any acceleration to which it may be subjected. It is usually graduated in gradients of so much per cent., and in accelerations expressed as feet/sec^2. Among other uses to which this instrument can be put, are the measurement of power losses in trains, tram-cars, and motor-cars, when running at various speeds, draw-bar pull, and the brake-horse-power given out by battery motors as used on cars.

The Lithanode Co.

This firm showed a collection of accumulators fitted with Lithanode plates, and adapted for use with hand-lamps, medical apparatus, &c. The firm's patent "Unspillable" arrangement consists of a small chamber at the side of the celluloid container, connected with the internal space and the exterior of the box by tubes in such a way that it is impossible for any of the electrolyte to escape, no matter how the cell is handled, though the gases can escape freely. The construction of the plates gives lightness and rigidity combined with low resistance and freedom from buckling, and a special terminal insulator is used to prevent corrosion. Sets of cells for laboratory use, hand-lamps equipped with removable cells, a battery for medical use fitted with a rheostat for cautery and lighting, and small switches, &c., of Gallalith, were also shown.

The London Electric Firm.

This firm showed the ingenious arc-lamp lowering gear, without ratchet or gear wheels, associated with its name, which achieves remarkable results, considering its compactness and simplicity.

(To be continued.)

LEGAL.

The Electrical Co., Ltd., v Oliver H. Thomas, Son and Co., Ltd.

(Continued from page 973.)

Mr. Sankey concluded his opening, and read a mass of correspondence, in the course of which he referred to a letter in which the machinery stipulated for was a Roby vertical engine, capable of developing 120 h.p. with 80 lb. steam at the stop valve, with a generator capable of an output of 90 kw., 50 periods, 500 volts at 720 r.p.m., also two centrifugal pumps with an output of 250 gallons per minute.

Mr. Jacob Stottner, of Hendon, was called, and stated that he was formerly general manager for the plaintiff company, but had since resigned, his resignation taking effect in March of last year. Witness was general manager to the plaintiffs during the time of the contract in question, he went down to the colliery in June, 1907, for the first time, and took the matter into his own hands. When he arrived he inspected the plant, which he found standing idle, and it seemed to be in good condition mechanically, but was in a neglected state. They got steam up and found everything was all right with the exception of the exciter, the commutator of which was dirty and the surface slightly oxidised. Plaintiffs' mechanician, Johnson, who also came down, took the machine to pieces and cleaned it throughout.

Mr. Abel Thomas: What is the commutator?—The vital part of a direct-current machine, and if it were not kept scrupulously clean, especially on small machines like the one in question, difficulty would be encountered in getting the machine to excite.

What was the state of the brushes?—They were as dirty as the machine. The plant had been standing for a long time.

Further examined, Witness said that when he examined the machine in question, there was absolutely nothing wrong with the exciter, and if defendants had employed a competent driver it would have given no trouble. At the time he went down, the pumps and motors were on the surface, but the latter appeared as if they had been under water, because there was some slime which had dried upon them and a deposit from the water. The effect of these two things was, of course, very detrimental to the insulation of the machines.

The Official Referee: Water is a good conductor of electricity, is it not?—Pure water is not but dirty water is, and in the dirty water which was upon this particular motor there was a very dangerous element.

Has your firm supplied many motors for pumping in mines?—Witness replied that they had, and that they had a reputation to maintain.

Further examined, Witness said that on one occasion he saw Mr. Thomas and suggested that they should come to an amicable settlement in the matter; at the same time he endeavoured to convince that gentleman that the plaintiffs' machinery was not in any way defective, and offered to supply defendants with a skilled electrician to unwater the mine if defendants would supply the necessary labour, &c. This Mr. Thomas agreed to, and an arrangement to that effect was entered into.

Counsel: What was the reason, in your opinion, for the drowning out of the mine?—After the occurrence it was impossible to examine the starting arrangements of the pumps, because they were in the flooded part of the mine, but his opinion was that it was caused by the bad condition in which the starter was in, and that it was making bad contact. Later on, when they were able to get the starter up out of the mine, he found that he was right in his opinion. The starter was in a bad condition, and only made contact in two phases, instead of three. The contact fingers were very badly burnt.

In answer to Counsel, Witness said that these contact fingers frequently wanted replacing.

Counsel: What do you say about using a starter for close upon 12 months, without doing anything to it?—That was a very long time. The contact fingers were usually replaced every three months, but, of course, it depended greatly on how often the machine was started.

Witness was then questioned at very great length as to the working of the pumps, the state of the delivery pipes, the train rails, &c. The latter, he said, which were supplied by the defendants, were very defective in condition, and caused considerable delay in carrying out the contract.

Mr. Stottner, in the course of further examination, said that one occasion the driving belt came off. It was the duty of the engine driver in charge to see that the belt was properly fixed, and on a previous occasion Witness had warned defendants' man with regard to the matter. He had noticed that a lot of fat was being used to make the belt stick to the pulleys, and that was a very bad thing to do. Witness had told defendants' men not to put any more on, because if too much fat was used the belt would slip on the pulley surface, with the result that the friction caused heat which warmed the fat, and then the belt slipped right and left.

Cross-examined by Mr. Williams, K.C., Witness said the plant was to consist of two centrifugal pumps, complete with motors and switch gear, capable of raising 250 gallons per minute against a 24 ft. head. Witness believed Mr. Thomas elected to have an electrical plant, acting on the advice of Prof. Galloway.

The hearing was continued during the week, when Mr. Stottner, was further cross-examined by Mr. Williams, K.C., for the defence.

Questioned as to the trouble which arose with regard to the centrifugal pump, Witness said that with clear water the pump might have worked ever so long without corroding on the inside.

Mr. Williams: Do you expect to find when a mine is flooded that the water you have to pump will be entirely clean water?—The corrosion of the pump depended largely upon the chemical composition of the water.

Is it a fact that there was a very small profit on the contract?—Yes.

Did you cut down the price as low as possible?—We were cut down by Mr. Thomas.

But you would not have been cut down without your consent?—Of course, we agreed to it. We agreed to take the order on a very small profit.

In order to secure the contract?—Quite so.

And you bought cheaply?—Of course, we tried to buy as cheaply as possible.

And cheapness involves nastiness?—Witness denied that this was the case. Referring to the visits of plaintiffs' representatives to the mine, Witness said that Mr. Thomas liked to see as many of plaintiffs' representatives there as possible while the work was in progress. It was business diplomacy and created a good impression. About this time plaintiffs' firm had various contracts for the erection of electrical mining installations in South Wales, but he denied that they did not send enough men to look after and do the work at defendants' colliery.

Counsel then proceeded to cross-examine Witness with regard to the complaints as to the working of the exciter, and read a report from a Mr. Blake, one of plaintiffs' own engineers, in which he expressed the opinion that the field coils of the exciter were wrongly connected.

Witness denied the accuracy of the report, but admitted that if such had been the case, the fault would be in plaintiffs' works.

Counsel: I suppose your firm, being a big company, would not employ men on work of this kind unless it was satisfied as to their skill?—Quite so; we don't employ them unless they are skilled.

Counsel asked if a wrong connection of the field coils was a mistake a skilled man would be likely to make, and Witness replied that he did not know enough about field-coil work to express an opinion. He should say, however, that if they had been wrongly connected the machine would not work at all. It was quite true plaintiffs took no steps to inquire into Mr. Blake's suggestion, because they were certain that there was nothing in it. They had the test sheets of every machine, and it would be impossible for such a mistake to arise.

Counsel: Would running the engine about 10 per cent. below its normal speed account for trouble with exciter?

Witness admitted that it might do so, because the exciter would be running at a lower speed, and would thus make the excitation a difficult matter. Small machines sometimes excited very slowly. When he was at the mine, however, he had no trouble whatever with the machine, and the fact that it excited once satisfactorily showed that the machine was in order.

Counsel: And therefore it ought always to excite?—Quite so.

Witness admitted he could not understand Mr. Blake's suggestion; the machine was quite all right, and if it had been properly attended to there would have been no difficulty with the excitation. At a later date, when the machine was taken to pieces and examined, the only suggestion which could be made with regard to any difficulty in starting was that the residual magnetism of the machine was low.

The hearing was continued on Tuesday, December 21st, when Mr. Stottner was cross-examined for the seventh day in succession. At the close of the day the matter was adjourned until after the Xmas vacation. Our report of Tuesday's evidence will appear next week.

Reeves *v.* Manchester Corporation.

At the Manchester Assizes on the 17th inst., Arthur Henry Reeves, Rusholme Grove, Rusholme, a coachman and chauffeur, sued the Manchester Corporation for damages for the loss of his left arm. His case was that about eleven o'clock p.m. on May 15th he and a friend were about to get on to a Corporation car which was stationary at the junction of Stockport Road and Dickenson Road. It was a single-deck car with a platform at each end. Plaintiff mounted the footboard leading to the platform at the front of the car, and was holding the rail when the guard said to him, "The car is full," put his hand on the plaintiff's shoulder and pushed him. The car started and the plaintiff fell on the road on his back. The wheels of the car passed over his outstretched left arm, which was so mutilated that it was amputated at the Royal Infirmary. The defence was that the plaintiff got on the wrong car, and, finding his mistake, stepped backwards from the platform and fell. It was denied by the plaintiff that he left the car voluntarily, and he called witnesses who said they saw the guard push him. The guard and others denied that he pushed the plaintiff.

Mr. Justice Bray pointed out that it was for the plaintiff to prove his case and to satisfy the jury that the accident happened owing to some negligence or wrongful act on the part of the defendants' servants. In this case no contributory negligence was alleged, and the jury had to decide between the conflict of evidence.

The jury found for the plaintiff and awarded him £275. Judgment for that amount was entered with costs.

Eccles Corporation *v.* South Lancashire Tramways Co., Ltd.

Mr. Justice Eve, in the Chancery Division on the 16th inst., heard an action by the Corporation of Eccles (Lancs.) against the South Lancashire Tramways Co., by which they sought to restrain the tramway company from trespassing upon a section of about 500 yards of their electric tramway system. The Salford Corporation were also added as defendants, owing to an arrangement which they had made with the Eccles Corporation to work the line, and a licence which they had granted, without the permission of the Eccles Corporation, to the tramway company, enabling them to run over the section in question.

The defendants pleaded that they were acting within the powers conferred upon them by the working arrangement in permitting the defendant company to use the line as they were doing.

Mr. P. Ogden Lawrence, K.C., appeared for the plaintiffs, Mr. Jessel, K.C., for the South Lancashire Tramway Co., and Mr. Clayton, K.C., for the Salford Corporation.

Mr. P. O. Lawrence, in the course of his opening, said that the tramway company were running their tramcars over a portion of the Eccles system without any licence or authority from the Corporation, but they claimed a right to do so as they held a licence from the Salford Corporation, with whom there was an arrangement for running powers. The case, he said, depended mainly upon certain clauses in the Acts of Parliament and the agreement between the two Corporations, and he contended that the plaintiffs were prejudiced by the position taken up by the tramway company.

Evidence was called for the plaintiffs to show the relationship which existed between them and the Salford Corporation in regard to the tramlines, and some of the witnesses stated that damage

was occasioned by the vibration of the company's cars, some of which were light and unsteady. The Eccles Corporation, it was stated, not only did not give the Salford Corporation authority to enter into an agreement, but objected to their doing so, although they would not have objected themselves to have granted powers to the company to use the section in question.

For the defence it was argued that the arrangement was for the public convenience, as by it was accomplished the desired object of getting continuity of service from Liverpool through Salford and Worsley to Manchester.

Mr. Clayton, for the Salford Corporation, contended that the rights of the Eccles Corporation, conferred by their Tramways Act, had been passed on to the Salford Corporation, without interfering with the Eccles rights or position. The licence granted to the tramway company by Salford was only a revocable licence, and therefore could not interfere with the rights of Eccles, and by granting it Salford had not committed any breach of their agreement with Eccles. Salford Corporation were acting within their rights when they granted the licence to the company, and if any extra burden were thrown upon Eccles by running the cars over the section in question, the liability would be upon Salford, no doubt.

Mr. Jessel, for the South Lancashire Tramways Co., said that his clients were in the unhappy position of being between the anvil and the hammer, and were the victims of the jealousy which existed between the two corporations. They had Parliamentary powers to work the tramway with the consent of anybody who had power to grant it, and he contended that Salford had such power.

Mr. Lawrence contended that Salford, as lessees, had no power to grant a licence to a third party. Such a licence could only be granted through the Board of Trade. The Eccles Corporation had no power to give the Salford Corporation authority to grant such a licence, even if they so desired.

His Lordship reserved judgment, stating that if possible he would give his decision before the vacation; but if he was unable to do so, two or three weeks' delay could not do harm to any one.

Arthur v. Henderson.

In the King's Bench Divisional Court on Wednesday, December 15th, Mr. Justice Darling and Mr. Justice Pickford heard an appeal from the decision of the learned Official Referee, Mr. Pollock, in this action. It appeared that in 1904 the parties entered into negotiations for a lease of the Fulham Theatre. Whilst these negotiations were in progress, Mr. Arthur made inquiries as to the condition of the electric lighting installation at the theatre, with the result that on November 25th, 1905, a letter was written and signed by Mr. Henderson, in which he undertook, if the electric light was not in order, to execute the necessary repairs at his own expense. That was before the lease was executed. Under the terms of the latter, however, Mr. Arthur was pledged to keep everything in repair, and the learned Referee refused to consider the letter, as being inconsistent with the terms of the lease. When the electric light was tested, it was found to be in need of repair to the amount of about £900. Appellant claimed that the letter should have been admitted as evidence.

Their Lordships allowed the appeal, and ordered the matter to be referred back to the Official Referee.

Byatt v. Krieger Electric Carriage Syndicate, Ltd.

On Friday last Mr. Justice Grantham and a special jury concluded the hearing of this action, Miss Ivy Byatt and her father, Mr. Henry Byatt, the novelist, being awarded damages in respect of personal injuries sustained by the former.

According to the evidence, it appeared that while cycling along Queen's Gate on June 30th last, Miss Byatt was knocked off her machine by one of the defendant company's broughams, with the result that she was completely paralysed below her shoulders, and, said her Counsel (Mr. Montague Lush, K.C.), nobody could predict anything more for her than a lingering death. The plaintiff's case was that Miss Byatt was overtaken by the brougham, and on hearing a warning sound she swerved to the left, notwithstanding which the brougham ran into her.

For the defence, it was alleged that just before the brougham reached her, Miss Byatt swerved to the right, and the accident was unavoidable.

The jury found for the plaintiffs, and assessed damages at £1,340.

Judgment was entered accordingly, but it was stated that an arrangement had been come to by which, on the defendants paying £500, the plaintiffs would not impede their appeal.

The Phosphor Bronze Company.

The petition upon which on Tuesday last Mr. Justice Swinfen Eady directed the compulsory winding-up of the Phosphor Bronze Co., Ltd., was mentioned again.

Mr. Clauson, representing the petitioners, stated that the company had now made arrangements by which they could pay the whole of the petitioners' debt and costs, and they were prepared to do so within two or three days. They had communicated with the petitioners, and he now asked his Lordship to stay the drawing up of the order for seven days, in order to see whether the debt was discharged.

His Lordship said that he could not make an order in that form. If the petitioners were willing he would dismiss the petition, otherwise the order must stand.

Mr. Grover, for the company, asked his Lordship to allow the order to wait for a few days.

His Lordship said he could not. If the parties agreed out of Court, however, he would dismiss the petition.

Mr. Clauson said he was not instructed to ask his Lordship to do that.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

New Patent Brush-holder.

Messrs. H T. Boothroyd, Ltd., of Bootle, Liverpool, are bringing out an extremely simple brush-holder, made entirely of wire, the invention of their general manager (Mr. J. H. Woollis-croft). The device, which is known as "The Agile," is shown in the accompanying figure (fig. 1). It will be seen that the carbon is guided by a wire frame, to which it is electrically connected by a flexible tail; the upper end of the carbon brush is provided with a notch, in which lies the pivoted wire presser, preventing the brush from tilting. The pressure is adjusted by sliding the small spring along the presser, and the holder is clamped in position on the carrier by means of the wire toggle clip shown full and dotted at the right hand. There is not a single screw in the holder, and the whole thing can be put on or taken off in confined spaces, such as the interior of a totally-enclosed motor, with ease. The carbon has a long feed, and can be held off the commutator by resting it on the top of the wire guide close to the tail connection. The lightness of the parts enables the brush to follow the surface of the commutator and minimises the effects of vibration, the "agility" of the holder, to which it owes its name, making it especially suitable for use on high-speed machines. Naturally the construction is very inexpensive.

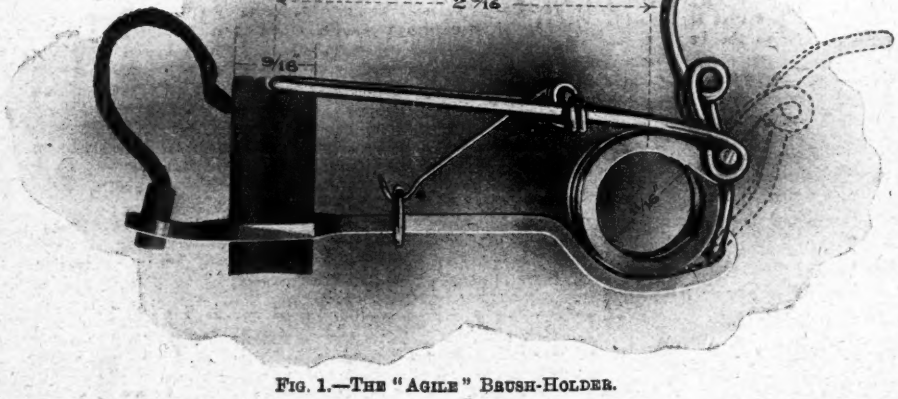


Fig. 1.—The "Agile" Brush-Holder.

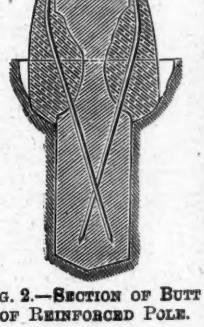


Fig. 2.—Section of Butt of Reinforced Pole.

Reinforcing Decayed Poles.

A simple method of reinforcing poles which have suffered decay at the ground level is shown in the accompanying section (fig. 2). The pole is supported with a tripod, while a trench is dug round the butt, descending as far as the healthy part of the wood; a cage of steel rods is then formed round the base, the rods, ½ in. n

diameter and 3 ft. to 5 ft. long, being pointed at both ends and driven into the wood as shown. The rotten wood having been removed from the butt, concrete is rammed round and inside the cage, forming a massive socket or pedestal. If the whole of the butt below ground is rotten, a substantial false butt of concrete is formed in its place, to receive the ends of the steel rods, the upper part being finished as before. It is stated that by adopting this method, which was devised by Mr. Orr, of the Allegheny County Light Co., U.S.A., a great saving is effected—the cost of strengthening a 30-ft. pole being 14s., compared with £5 for renewing it. The chief item of expense in renewing poles is not the cost of a new pole, but that of changing over the insulators and wires, which is avoided by the method described.

LEAD.

The formation of a combination of lead interests, though apparently it has done little to affect the price of the metal, has the effect of drawing attention to the possibility of a central control in a second of the products affecting electrical machinery. Lead affects the industry particularly through the manufacture of accumulator plates, and its use as a protective sheathing for cables, a covering, too, for which it would be difficult to find a substitute. Its use in fuse wire, though extensive, can hardly be considered important. In the two former branches the electrical industry would be as unpleasantly placed as the building trade and others (water supply, drainage, &c.) to whom lead is indispensable, should a considerable increase of price be possible. The continued steadiness of the metal is reassuring in this respect. Lead, the use of which, of course, dates back to pre-financial times, has, since a record of prices has been kept, never reached what may be called the starvation limit; it rises naturally on the discovery of a new source of demand, but recovers its own level again by the cheapening of means of production, or the opening of fresh or abandoned mines, the supply of it being plentiful, and it being also a by-product to silver mining.

The largest producers are the United States, Spain and Germany. Mexico and Australia come next in importance, England, at one time the leading country for lead-mining, being now very low on the list, with 21,000 tons for 1908, out of a total 1,052,500. The outlook for the home producer is not without encouragement, however, as two mines were reopened in Cardiganshire early in 1909. In fact, the total "obtainable" in this country for 1908 (39,700 tons, including imported ore) bears a curiously small relation to the total consumption of Great Britain, as given by the German Metallurgical Associations in their annual "comparative statistics." Here we find that, for 1908, the consumption of Great Britain was 228,800 metric tons, that of the United States 321,000 tons, Germany 211,300 tons, and France 103,000 tons. This leaves less than 200,000 tons for the rest of the world, supposing the output figures to be accurate.

Of recent years the price has certainly declined, it being now some £6 lower than in 1901.

BUSINESS NOTES.

Calendars and Catalogues.—British Insulated and Helsby Cables, Ltd., Prescot.—New pamphlet (56 pages) (No. P. 104, Supplement No. 2) very finely produced and fully illustrated, relating to the Prescot overhead material for electric tramways. Trolley wire, ears, hangers, pull-offs, splicing tubes, line insulators, mechanical frogs, crossings, section insulators, trolley heads, and trolley line tools, are all shown and priced. The last few pages contain a long list of tramway and railway contracts that have been carried out, and of the firm's numerous branches and sub-agencies in all parts of the globe.

Messrs. Thermit, Ltd., are wishing their friends the Season's Compliments by the medium of another of their handy pocket memoranda books. There are a number of pages describing the Thermit welding system and the progress it is making, and two pages contain calendars for 1910 and 1911; the remainder is all plain for note-making. There is a pocket inside the front cover and a pencil at back edge.

The Electric Construction Co., Ltd., have a happy knack of doing things nicely at souvenir time. Last year they sent to their friends a match-box as though to suggest lighting the pipe of peace, and, we believe, a bulky piece of rubber for erasing any unpleasant recollections. This year they have just favoured us with one of the neatest little vest-pocket diaries that we have ever seen, with card and stamp pockets. The name of the company does not intrude itself—it appears inside the case in small gilt lettering, but nobody receiving it will forget from whom it came, as it is so different from others. With it there has come a handy penknife with which we shall hope to cut out many a newspaper paragraph regarding contracts booked by the company in the coming year.

To the Electrical Power Storage Co., Ltd., of 4, Great Winchester Street, E.C., we are once more indebted for a very serviceable desk blotting pad and diary, with its so familiar top monthly date edging. May our first paragraph to be blotted thereon be one of good wishes to the company, hoping that they will have excellent business to fill, and a capital report to issue, during 1910.

Messrs. Falk, Stadelmann & Co., Ltd., 83/87, Farringdon Road, E.C.—In order to keep the "Efesca" lamp in mind, the firm have issued a small vest-pocket folding card with calendar for the year 1910. There is a turned up corner in the shape of a lamp, behind which you may keep stamps for a time. Firms selling "Efesca" lamps can have quantities of the calendars with their own name printed thereon. A copy of list P. 659 has also been received. It gives prices of, and some other information regarding, high candle-power "Efesca" lamps, which they can supply in 100, 200, 300, 400, 600 and 1,000-c.p. sizes, for 100 to 260 volts for shop front, street, railway station, and other lighting.

The A.E.G. Electrical Co., of South Africa, Ltd., Caxton House, Westminster, S.W.—12-page illustrated brochure (in English) devoted to "Electricity Applied to Printing." Several electrically-operated German presses are illustrated. A collection of other literature in the firm's standard form deals with the following subjects:—Switchboard measuring instruments (electromagnetic), also continuous current moving-coil instruments, electric ceiling fans, automatic starters for three-phase motors, continuous current interpole railway motors, and lead-covered cable accessories (branch joint-boxes).

Messrs. G. M. Boddy & Co., 15, Gray's Inn Road, W.C.—Leaflet giving latest prices of "Metallik" lamps.

The Dowsing Radiant Heat Co., Ltd., 24, Budge Row, E.C.—List of luminous electric radiators for the 1909 season. Many designs are shown and prices are stated.

Messrs. L. E. Wilson & Co., 20, Cross Street, Manchester.—Price leaflet of the "Thomson" police lamp.

The C.W. Hunt Co., New York.—Catalogue (No. 096), giving illustrated notes regarding their dumping tubs and grab buckets.

The Electrical Apparatus Co., Ltd., Milford Works, Queen's Road, Battersea, S.W.—Complete catalogue consisting of a collection of lists brought together in a neat binding cover, containing a description with clear illustrations of ampere-hour meters, pre-payment meters, motor starters, shunt field regulators, starter regulators, D.C. motor panels, one-minute motor starters, and "Electrostan" fuse wire.

Messrs Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, N.E.—Two new publications. One shows and briefly describes numerous designs of shop window reflectors for use with tantalum lamps; the other gives prices of the new types of low candle power tantalum lamps, to which allusion was made on page 976 of our last issue, and particularises the alterations that have been made in style of bulb. The lamps are now made in voltages ranging from 20 to 240 volts for ordinary use. Copies of this leaflet can be supplied to contractors, dealers, or ironmongers, with their own name printed on if they so desire.

The General Electric Co., Ltd., 71, Queen Victoria Street, E.C.—A further batch of publicity literature has been received from this company. The principal item is a finely-illustrated catalogue of electric heating and cooking apparatus, and it includes a number of new designs of radiators (luminous, convector, and conduction types), stoves, chafing dishes, water heaters, ovens, irons, kettles, &c. The second is section C (No. C 1,371) giving prices of "Geekoduct" insulated conduit (especially suited for tropical climates) and accessories. A third relates to A.C. transformers for "Osram" lamps and other purposes; while a fourth details the "Angold" enclosed arc lamps (short shuntless type) of which it is stated there are over 100,000 in use. In all the lists prices are very clearly indicated. The transformer and Angold lists contain reduced prices. Some loose blotters for desk use give a calendar for the months of January and February in out-lined lamps, and an inch measure at foot, and they remind the user of the current-saving qualities of Osrams. We have also received the "G.E.C." Daily Reminder for 1910—a set of calendar slips slotted to fit the wooden stands distributed last year, each slip bearing a reference to some feature of the company's activities—and a handsome writing pad, provided with pockets for stationery and an ample store of blotting paper. A similar souvenir was sent us in 1907, and we cannot better express our appreciation of its admirable qualities than by recording the fact that we have used it continually for the past two years, and have found it a most handy, convenient and durable desk companion, which we should be sorry to part with.

Mr. G. Braulik, 8, Lambeth Hill, E.C.—Leaflet drawing attention to the "Düsseldorf" counter-current circulation economiser, for which he is agent.

Messrs. Sanders, Rehders & Co., Ltd., 108, Fenchurch Street, E.C.—Leaflet describing a new form of "Sarco" patent feed-water weigher.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, E.C.—List tabulating particulars of hard-drawn aluminium cables for electrical transmission lines, with copper equivalents.

The Electric Control and Reducer Co., 15, Oxford Street, W.—Leaflet describing the Martin patent regulator, with directions for fixing and use.

We are indebted to Messrs. Siemens Bros. & Co., Ltd., and Siemens Bros. Dynamo Works, Ltd., for copies of their self-opening pocket diaries for 1910. The 48 pages that precede the diary section are occupied with a variety of useful tabulated matter of a general and engineering character, and particulars of the Siemens companies, their contracts and branches, with illustrations of their manufactures. A serviceable memoranda section appears at the end.

Messrs. Simplex Conduits, Ltd., 116, Charing Cross Road, W.C., have favoured as again this year with one of their very useful and neat breast pocket diaries (black and gilt cover and gilt edging) with ample memoranda space (squared paper). Some 16 pages (quite unobtrusive) of matter relating to Simplex specialities precede the diary pages, and the latter are followed by 32 pages of useful tabular and other information for contractors and electrical engineers generally.

The Electrical Co., Ltd., 121-125, Charing Cross Road, W.C.—Twelve-page illustrated list with prices of electric heating and cooking apparatus, including kettles, water heaters, urns, heating plates, hair curler heating and hair drying apparatus, &c.

Messrs. Siemens Bros. & Co., Ltd., Caxton House, Westminster.—New catalogue, No. 512, containing complete illustrated descriptions of their frequency indicators and vibration tachometers, both of which instruments are designed on the vibratory reed principle. The vibration tachometer is designed to indicate the speed of any type of machine.

Hart Accumulator Co., Ltd., Marshgate Lane, Stratford, E.—Once again this company has favoured us with one of its desk blotting pads, with convenient top pocket.

Messrs. Hayward-Tyler & Co., Ltd., 99, Queen Victoria Street, E.C.—Pocket diary for 1910, with a small space for every day in the year. A good number of pages are devoted to illustrations of the firm's pumping engines and to tabular data of interest in connection with their manufactures.

The Western Electric Co, Norfolk House, Victoria Embankment, W.C.—Very neat hanging wall or desk calendar for 1910, with a complete calendar for the year unobtrusively printed half on either side of a collection of monthly tear-off slips.

Messrs. Hamilton Bros, Glasgow.—Hanging calendar with monthly slips, drawing attention to the "W H" ironclad electric control.

The District Electric Co., Ltd., 35, Queen Street, Wolverhampton.—Wall calendar for 1910, with monthly slips placed below a print, "The Rising Moon."

Messrs. Nalder Bros. & Thompson, Ltd., 34, Queen Street, E.C.—Convenient hanging calendar for 1910, with monthly tear-off slips, in the firm's usual style, with clear figuring for dates.

Bankruptcy Proceedings. — Edward William Barton-Wright, electro-therapeutic specialist, and lately managing director of the Bartitsu Light Cure Institute, Ltd., 1, Albemarle Street, Piccadilly, W.—The first meeting of creditors was held at the London Bankruptcy Court on Monday before Mr. E. Leadam Hough, Senior Official Receiver. The company was promoted by the debtor in March, 1906, with a nominal capital of £10,000, subsequently increased to £22,500, to take over and develop, as a going concern, the business of the Bartitsu Light Cure and Electro-Therapeutic Institute, which he had previously carried on. The chairman reported that it appeared from the debtor's statements when before the Examiner that he acted as managing director of the company until last January, when it went into compulsory liquidation. The business was sold in April last, and the debtor had since acted as manager for the purchaser. He disputed the claim of the petitioning creditor, and did not admit insolvency, although the only assets disclosed were certificates for 6,000 shares in the Bartitsu Light Cure Institute, Ltd., to which no present value was attached. The meeting was adjourned for three weeks to enable the debtor to submit an offer.

Robert E. Walker, electrical engineer and cycle agent, Hereford.—A receiving order has been made on a creditor's petition.

Book Notices.—*Who's Who*, 1910, and *Who's Who Year Book* London: A. & C. Black. 10s. net. and 1s. net.—We cannot remember the number of times that we have to refer to our *Who's Who* in the course of the year, but they are very many. It nearly always tells us what we want to know, and we are quite sure that it is one of the books that it is least easy to dispense with from the reference shelves of any study. Every man or woman who has to do with matters of public or social interest frequently desires or requires to know something about others who are concerned therewith, and perhaps some who have nothing to do with them at all. In this book their case is well met. The *Year Book* is a supplementary companion, in which further matter is arranged in easily accessible tabular form. As the publishers say, "the lesser book is a key to the larger one."

The Englishwoman's Year Book, 1910, 2s. 6d. net, and *The Writers' and Artists' Year Book*, 1910. 1s. net.—These are two reference works of a somewhat similar class to the above, and they are issued by the same publishers. The former is an interesting book which should be increasingly in demand in these days, when women are seeking to turn their days and nights to more profitable account. Our wives and daughters loom somewhat largely on the horizon in the future of political matters, and those whose ambitions lie that way will find something to aid them in their pursuit; but for that greater company who are contented with the domestic, social, religious and charitable occupations or avocations, the book is of most value. Matters educational, professional callings, employment in medical and many other capacities, such as art, music, literature, nursing, and so forth, are handled fully, while sports, pastimes, travels and "animals" are not overlooked. We can imagine many a worse Christmas gift than these four reference books.

"*Mechanical World*" *Electrical Pocket-Book for* 1910. Manchester: Emmott & Co. Price 6d. net.—The new issue of this book has been printed on thinner paper, effecting a decided improvement. The contents have been revised and rearranged, and many new sections have been introduced, the subjects including the Conduit System, Cheap House Wiring, Meters, Carrying Capacity of Cables, and so on. The book contains a great variety of information in tabloid form, covering a wide range of electrical applications, and is remarkably cheap at the price.

"On Some Causes for our Declining Steel Trade and their Remedy." By Benjamin Talbot, managing director of the Cargo Fleet Iron Co., Ltd., Middlesbrough. 20 page pamphlet.

Closed for the Holidays.—Messrs. Brook, Hirst and Co., Ltd., of Chester, announce that their works and offices will be closed from to-night, 24th inst., until Wednesday, 29th inst.

Messrs. Watson, Laidlaw & Co., Ltd., of Glasgow, announce that their works and drawing Office will be closed on December 31st and re-opened on January 7th. The counting-house will re-open on January 4th.

Electrical Enterprise in China.—Reporting on the foreign trade of China, Mr. W. P. Ker, Commercial Attaché to His Majesty's Legation at Pekin, states that the value of machinery imported in 1908, though less than in 1907, was again much greater than in previous years, and is likely to increase as Chinese mills and factories of all kinds are constantly being started. It is impossible to ascertain the origin of the machinery, but there is every reason to suppose that British manufactures take a leading share. The trade is one which demands close attention and vigorous nursing by expert technical representatives in China, and there are welcome indications that British firms are determined not to be left behind. In Shanghai one or two British firms have opened showrooms for machinery, in charge of qualified engineers, where Chinese buyers can see the machines actually working. For cotton mills and oil mills British machinery is almost exclusively used, but orders for flour mill machinery have mostly gone to America. The chief feature of the year in connection with the machinery trade was the number of orders placed for electric light installations. One of the largest installations, that at Hankow, was contracted for by a British firm. Amongst others, electric light was installed at Antung, the plant being of British manufacture imported from Japan; the British Concession at Chinkiang was supplied with light by the native electric light company already lighting the Chinese city; an electric light company was formed with a small capital to light a new street at Chengtu, the capital of Szechuan, and it contracted for an installation which may be extended if successful; electric lighting was started on a small scale at Chungking in June, 1908, with plant purchased from the United Kingdom through a British firm at Shanghai, and this year tenders from various firms were being considered for a large plant to light the whole city; the electric light company at Swatow was reconstructed with a capital of $140,000, and new engines were ordered from Europe for relighting the town in July, 1909; a Chinese electric light company, formed two or three years ago at Wuhu, commenced operations in April, 1909, with 3,000 lamps, but with plant sufficient for 6,000 16-candle lamps—machinery mostly of British manufacture. The electric light company and the waterworks company at Hankow imported over £260,000 (? dollars, Eds) worth of fittings direct from the United Kingdom in 1908; and the extensive electric lighting systems already at work at Shanghai, Canton, Tientsin and Pekin continued to extend their operations. Electric lighting at Newchwang begins this year, and a project for lighting Amoy was mooted in 1908, but failed for want of capital. Tientsin led the way in electric tramways some years ago, and in 1908 about nine miles were open to traffic, nearly all double tracks, worked by the Compagnie de Tramways et d'Eclairage Electriques de Tientsin, a Belgian concern. The spring of 1908 witnessed the inauguration of two electric tramway services in Shanghai, one in the International Settlement covering 26 miles, and one in the French Settlement covering 15 kiloms. The former has 65 cars, and carries nearly 30,000 passengers per day; the latter has 20 cars in service carrying a daily average of 7,450 passengers.

Trade Announcements.—Messrs. Babcock & Wilcox, Ltd., are to-day removing their Manchester office from 14, Deansgate, to more commodious premises at 30, Cross Street, Manchester. The telephone number will remain as before—No. 3,112 City, and the telegraphic address "Babcock, Manchester."

The Soho Scientific Instrument Co. report that their new building, containing offices and showrooms, is now complete, and they request that all communications be addressed to 175, Wardour Street, W. The works were closed from December 6th to December 20th during removal to Wimbledon, S.W., where additional new plant has been installed.

Messrs. Neville, Williams & Co., are removing from to-day's date to larger and more convenient premises at 80A, Southwark Street, S.E.

The registered offices of the National Telewriter Co. have been removed to 20, Bucklersbury, E.C.

We learn that, after official inspection of "Imperial" water-tube boilers under construction in the works of Edwin Danks & Co. (Oldbury), Ltd., the Admiralty have placed the company upon their list of manufacturers of water-tube boilers. The Water-tube

Boiler and Engineering Co., of 11, Queen Victoria Street, E.C., will furnish any further information desired concerning these boilers.

Dissolutions and Liquidations. — The Bradford Electrical Engineering Co., Ltd., carrying on business as electricians, at 65, Manningham Lane, Bradford.—A meeting of the creditors in connection with this liquidation was held on Wednesday, December 15th, at the Queen's Hotel, Leeds, the chair being occupied by Mr. Houston (representing Mr. G. E. Corfield, of London, joint liquidator), and there were also present Mr. Walker, on behalf of Messrs. Poppleton, Appleby and Turner, representing J. H. Tucker & Co., Simplex Conduits, Ltd., Messrs. Davis, Smith & Co., and the Electric and Ordnance Co., Ltd.; Mr. Wallis, representing the Electrical Contractors' Association; Mr. Scaife; representatives of the General Electric Co.; Siemens Bros. Dynamo Co., Ltd.; Wilson & Co.; Mr. Barclay, representing the Tudor Accumulator Co.; Mr. G. H. Lougee, representing the Bradford and District Bank; Mr. Douthwaite, representing Mr. C. A. Muller, of Bradford; and Mr. J. H. Haley, joint liquidator. Mr. J. H. Haley said that Sec. 188 of the Act enabled creditors to determine the necessity or otherwise of making an application to the Court for the appointment of fresh liquidators, other than the ones which had been appointed at the meeting in November, or to appoint a committee of inspection. If the creditors decided on either of these two courses it would involve considerable expense, and in order to obviate this they could, if they wished, appoint an advisory committee to act with the liquidators. At the meeting in November, the larger creditors had been called together to consult with the directors as to what steps should be taken in regard to the affairs of the company, the two managing directors having, on the wish of the directors, resigned their positions on November 18th last. A proposed scheme for establishing the business on a proper basis was laid before the meeting, whereby the creditors would have received 20s. in the £, and the business would have been continued. Unfortunately, certain creditors thought it advisable to wind up the business, and therefore the proposed scheme fell through. It was also decided that Mr. Corfield should act along with him (Mr. Haley) as joint liquidator in the winding up, and a meeting of shareholders was held on November 29th, at which it was decided to wind up voluntarily. The company was incorporated on October 30th, 1907, with a nominal capital of £3,000 divided into 3,000 shares of £1 each, of which 1,182 were issued, 732 being issued against cash and outside shareholders, and 450 to the vendors against the purchase amount as part consideration. The vendors were Mr. C. J. Cassé and Mr. H. H. Cassé, and the contract was based on a balance-sheet showing the following position on June 30th, 1907:—Assets, £278; stock, fittings, &c., £420; due by bank, £90; total assets, £788; deduct from this creditors for £222; assets shown over liabilities, £566. A trading account prepared at the same time by a firm of Bradford accountants showed a trade profit for three years of £770, or an average annual profit of £259. This balance-sheet was put forward as having been prepared and investigated for the purpose of forming the business into a limited liability company. Unfortunately for the shareholders, when he came to audit the statement of December 31st, 1907—two months after the company's incorporation—he found the accounts named to be incorrect. It appeared that there was an amount owing by the vendors under their contract with the company, which sum they were unable to make good. A prospectus was issued for private circulation, which stated that the vendors had agreed to accept £1,200 for the assets of the business, including £700 for goodwill. This prospectus, together with the accountant's balance-sheet, was submitted to him by the present chairman of the company, and he (Mr. Haley) told the chairman that in his opinion any payment for goodwill was not justified, and he advised that the amount of the goodwill should be taken out, and then, perhaps, the business could go on. This was agreed to. When, however, the accounts to December were taken, they showed a deficiency of £340 against the vendors, which they could not pay, and the shareholders were thereupon consulted, and it was agreed that the £340 should be dealt with as a loan. The amount owing had since been reduced to just short of £300. Ever since the company was formed the trading had not been profitable, and on September 30th last there was a deficiency of £303. The directors, having been for some time dissatisfied with the managers, determined to make a change. Subsequently he was consulted, and stated that he was not satisfied with the stock-taking. He was, nevertheless, of the opinion that the stock should be independently valued, and he instructed a valuer to go over it, and it was valued at £316 on October 31st, as against £600 on September 30th. The shareholders' capital having vanished, the directors, after consultation with the shareholders, decided that they would endeavour to pull the affair round, and they, therefore, decided on the meeting previously referred to in November. The statement of affairs to November 29th, 1909, now presented to the meeting was as follows:—Liabilities to unsecured creditors, £1,238; debenture-holders (deducted in contra), £100; contingent liabilities, £71, estimated to rank, £71; preferential creditors (deducted in contra)—rates, £13 9s. 5d., rent, £24—£37, total liabilities, £1,309; assets: book debts (£820) estimated to produced £650; furniture, fixtures, plant, &c., as valued by Mr. C. F. Scott, £56; stock-in-trade as valued by Mr. C. F. Scott, £317; work in progress, £25; cash at bank, £14; total, £1,062; deduct debenture-holders' £100, and preferential claims, £37 (per contra), £137; total assets, £924; leaving a deficiency of £385.

In answer to creditors, Mr. Haley said the scheme which was laid before the directors, and to which he had referred, could not possibly be revived now, and he did not think the creditors would get anything like 20s. in the £. The scheme had not been adopted, and he considered that it was a foolish step that had been taken. The stock had been valued as a going concern and not at stock price.

The Chairman stated that there was some slight hope of selling the business as a going concern.

Mr. Haley said the affair had been valued at what would be considered a fair price as a going concern.

A creditor asked if any explanation had been given by the previous managers as to the over-valuation of the stock, and Mr. Haley replied in the negative. The managers had left rather abruptly, and he had got as much information as he could out of them, but, of course, he could not get much.

After some discussion it was unanimously agreed that the appointments made at the November meeting should be confirmed, and on the motion of Mr. Lougee, seconded by Mr. Walker, an Advisory Committee, including Mr. Douthwaite and Mr. Barclay, was appointed to act in conjunction with the liquidators.

The following were the creditors over £10:—

Aland & Co.	£11	Haley, J. Herbert	£17
Atkinson	32	Johnson & Phillips, Ltd.	47
Braulik, G.	28	Krupka & Jacoby	1
Brit. West. Elec. Mfg. Co.	37	Muller, C. A.	2
Barwell, J., & Sons	16	Northern Electric Wire Co.	1
Bradford Corporation	18	National Telephone Co.	1
Bradford District Bank	176	Premier Accumulator Co.	2
Connolly Bros., Ltd.	38	Reavell & Co.	5
Crabtree, W. I.	30	Scattergood & Johnson	4
Eureka Conduits & Fittings Co.	22	Sun Electrical Co.	3
E.M.F. Manufacturing Co.	26	Strauss, G., & Co.	1
Electrical Co., Led.	34	Standard Cable Mfg. Co.	1
Electric and Ordnance Accessories, Ltd.	10	Tudor Accumulator Co.	3
Frankenberg, I., & Sons	43	Tucker, J. H., & Co.	2
General Electric Co.	43	Union Cable Co.	4
Hunt, J. A. H.	10	Veritys, Ltd.	2
		Wilson, G., & Co.	13

C. H. S. Naylor & Co., electrical engineers, 49, Lucie Street, Manchester.—Messrs. C. H. S. Naylor and H. Broadhead have dissolved partnership. Mr. Naylor will attend to debts, and continue the business under the old title.

With reference to a note appearing under this heading last week, regarding the Morris-Hawkins Electrical Co., Ltd., and its liquidation, we have pleasure in stating, in order to prevent any of our readers holding a wrong impression, that the Morris-Hawkins Electrical Co. has no connection whatever with Morris-Hawkins, Ltd., whose works are at Dagenham, in Essex, the head office being at 30, St. Mary Axe, E.C.

The Electro-Peat Coal Co., Ltd.—This company is winding-up voluntarily, with Mr. Lacey Downes, 11, Ironmonger Lane, E.C., as liquidator. A meeting of creditors is called for January 5th.

LIGHTING and POWER NOTES.

Argentina.—A concession has been granted by the Mendoza Government to the Cia. de Luz y Guerza de Mendoza, Sociedad Anonima, giving the company right to use the water of the Rio Mendoza adjacent to the Transandine Railway, in a hydro-electric plant for the supply of energy for industrial purposes. The concession carries with it the right to construct electric railways, and the first (15 km. long) is to be inaugurated at the same time as the hydro-electric station. The concession is for 50 years, afterwards becoming the property of the province.

Ashton-in-Makerfield.—The U.D.C. has agreed to energy being supplied to the Co-operative Society for lighting and to a biograph exhibition by the South Lancs. Tramway Co., but only "through the U.D.C."

Barnsley.—The T.C. has received from the L.G.B. sanction to a loan of £2,955 for E.L. purposes.

Bath.—With reference to the scheme for extending the area of supply into the R.D.C.'s area, the T.C. has decided to pay the R.D.C. £100 and certain costs, on condition that that body will support the application of the Corporation for powers, and that the E.L. Order of the R.D.C. shall be dropped or revoked as to the area covered by the application.

Beckenham.—The Council has agreed to extend the cables in Slurtt Way and Hayes Way in the Garden City of Park Langley, to supply 100 houses by March next; the Council has also agreed to join in the publicity scheme promoted by the Associated Municipal Electrical Engineers of London.

Belfast.—At the weekly meeting of the Tramway and Electrical Committee, the question of arc lamps for street lighting was postponed pending the abolition of the central poles already decided upon. A deputation appeared before the Committee to urge upon it the immediate extension of the tramway system in the Old Lodge Road. The deputation was informed that this extension would be included in the schedule.

Bishop's Stortford.—The post brings to hand a report by Messrs. May & Hawes, of Westminster, in the matter of electricity supply in the Council's area, which is to be discussed in January. The report is a straightforward document, and it shows that, without being too sanguine, there is a reasonable possibility of an electricity supply on the lines suggested for this small township of 8,000 people, being commercially successful in the course of

a year or two. The engineers rightly favour a simple crude oil engine plant and battery for carrying the light loads; distribution is to be on the three-wire system at 480 and 240 volts, and 111 metal-filament street lamps are included for an estimated capital outlay of £12,750. The estimated revenue at 5½d. per unit (gas being about 4s. per thousand), with a low average consumption, allows of an 8 per cent. gross profit and small surplus (£110) in the second or third year. The report is well worth the consideration, not only of the Bishop's Stortford authorities, but also of others similarly placed, we only regret that it omits all reference to overhead distribution.

Brighton.—The T.C. on December 16th adopted the recommendation mentioned in the Electrical Review last week to provide extra plant at Southwick power station and North Road sub-station, at a cost of £20,000.

Hanley.—The T.C. has decided to supply energy to the North Staffs. Railway Co. for new sidings and workshops at Cliffe Vale. The company will guarantee a minimum payment of £80 a year for a minimum of 19,200 units, and pay 1d. per unit for all above that amount.

Messrs. Wedgwood, Ltd., of Etruria, have informed the Council that they will shortly proceed with an electrical scheme at their works.

Canada.—An application will be made to Parliament next session for an Act incorporating a company, under the name of the St. Lawrence Power Transmission Co., Ltd., with a capital of $250,000 (about £50,000). The head office of the company is to be at Cornwall, Ontario.

According to *Canadian Machinery* for December, the Dominion Iron and Steel Co. is contemplating the erection of a number of new mills. A new power plant is to be erected capable of generating 4,000 kw. The pumping station at Sydney River is being equipped for electrical power. It is expected that these extensions will be followed by further additions of furnaces, ovens and mills.—*Board of Trade Journal.*

Cardiff.—The L.G.B. has sanctioned the borrowing by the City Council of £2,000 for the purposes of developing the electricity undertaking.

Continental Notes. — Germany. — The negotiations with the Rhenisch-Westfälischen Elektricitäts Werke for the electric lighting of the important mining town of Remscheid having fallen through, owing to difficulties as to the length of the concession, and the erection of a large and costly municipal station having been deprecated, the authorities have decided to join forces with the neighbouring mining centre of Barmen, which already possesses an electrical installation. A contract has been entered into whereby current is supplied by the latter to the extent of 600,000 kw.-hours per year, at a cost of 6 pfennige per kw.-hour, and above that quantity at the rate of 4·6 pfennige. The high-tension current will be forwarded by underground cables, the cost of which will be borne in the proportion of two-thirds by the town of Barmen and one-third by Remscheid. This arrangement is considered by local experts to augur well for the eventual linking up of all the electric stations between Solingen, Lennep, Ronsdorf and Barmen.

Coventry.—At the meeting of the City Council on Tuesday, the Electric Light Committee minutes were confirmed, stating that the manager had reported as to the increase of the demand upon the works, and that he had been instructed to prepare a scheme of extensions for the consideration of the Committee.

Croydon.—It is proposed to spend £1,150 out of the revenue of the electricity undertaking for sinking a well to provide water for the generating station. It is estimated that the probable saving will be £325 a year. Gas lamps in St. James' Road and Sydenham Road are to be converted to incandescent electric lamps.

Devonport Dockyard.—The authorities at the Dockyard express some fear that the main switches which are placed in each building for controlling the lights, may inadvertently be left in the "on" position at the close of the day, though the various lights may have been switched "off." To ensure, therefore, that at the close of each working day the electric current shall be shut off in all buildings not in use, electrical tell-tales are being fitted to all buildings having separate controlling switches. These tell-tales consist of two electric lamps enclosed in red shades placed against the outside of the buildings over the main entrance. They are so connected up that should the switch be left "on" contrary to the regulations, the lamps will continue to burn, and thus warn the police on duty. When the switch is turned to "off" the tell-tale lamps go out.

Doncaster.—The R.D.C. has approved sewage disposal schemes for the parishes of Adwick-le-Street, Oston and Skellow; the schemes have been designed by Messrs. D. Balfour & Son, Newcastle-on-Tyne, and in both cases pumping stations, with electrically-driven automatically-controlled centrifugal pumps, will be employed.

Dundee.—In accordance with the Provisional Order, the Electricity Committee of the T.C. has given permission for the laying of the cable for the electric light supply in Downfield. The cost will be £3,000 and the work is to be done gradually.

The Electricity Committee has also decided to carry out and spend money on a scheme of stair and close lighting at an inclusive charge of 8s. per lamp per annum. The lamps are to be switched on and off from the electric station, thus doing away with the vexed question of tenants' obligations.

Eastleigh and Bishopstoke.—In consequence of a letter from the B. of T. as to whether there was any probability of the U.D.C. putting the Electric Lighting Order into operation within the next 12 months, if the Board extended it for that period, the surveyor and Councillor Shepherd are to visit Basingstoke, Fareham, and New Barnet, to inspect the schemes adopted there, and report on the same.

Evesham.—The T.C. has been petitioned by 37 ratepayers in favour of an E.L. scheme for the borough, and the Stratford-on-Avon Electricity Co., Ltd., has put before the Council a proposal. The Corporation has decided, however, not to take any action in the matter at present.

Greystones.—At the meeting of the Rathdown (No. 2) R.D.C., Mr. R. S. Fry, secretary to the Greystones Electric Lighting and Power Co., wrote, stating that his company was prepared to supply electric current for the purpose of public lighting on the roads along which the company's mains were laid, provided the Council supplied the necessary standards and paid the company for light according to schedule. Mr. Hewson said he understood that the company was going to lay cables where it liked, and he suggested that the Council's secretary should be directed to communicate with Mr. Fry with a view to ascertaining if a B. of T. licence for lighting had been granted to his company. This was agreed to.

Hastings.—The T.C. has decided to apply for powers to supply electrical fittings, but, on the request of the local contractors, the powers will only be exercised through a contractor.

Heston and Isleworth.—The U.D.C. has agreed to the proposal of its electricity department to hold an exhibition of electrical plant and appliances in February, on condition that half the profits go to the Baths, in which it will take place. After some deliberation the U.D.C. has decided to extend its mains to a new building estate, but conditionally on the builders wiring the houses for electric lighting purposes. Only six candidates sat for the U.D.C.'s first free pupilships at the electricity department and other departments, and of these only three satisfied the examiners.

Hollingbourne (Kent).—The R.D.C. has consented to electricity being supplied from Maidstone to a new house being built at Boxley by Mr. F. R. Howlett.

Kiveton Park.—The U.D.C. has decided to apply to the L.G.B. for a loan of £3,316 for the provision of a refuse destructor with electric light plant.

Llandudno.—The U.D.C. has decided to have plans prepared for a permanent extension of the electricity works, so as to provide for additions during the next 10 years.

Llanidloes.—At a recent meeting of the ratepayers, a resolution was carried unanimously in favour of lighting the town with electricity.

London.—Marylebone.—The general manager of the electricity undertaking reports that there is a large field for freezing and ice-making plant in the borough, as it is now cheaper to make ice by electricity, for even a medium-sized house or shop, than to buy it. Upon his recommendation the Committee has decided that as ice making and freezing are mainly required in the summer, current for these purposes will be charged at 1d. per unit without any kw. charge. The present tariff for power is 2d. per unit for the first 125 hours per quarter of maximum demand and 1d. per subsequent unit. An equivalent tariff is 40s. per h.p. per annum, plus 1d. per unit for all units used, the annual charge to be added to the quarterly hire of motors charge. Subject to a separate meter being fixed for recording power units supplied, the alternative form of tariff above is to be adopted, as it appears more acceptable to consumers. Mr. Seabrook has prepared a statement showing the position of the undertaking to September 30th. The chief figures are as follows, the figures in parentheses being those for the corresponding period of 1908:—Units sold to private consumers, 3,463,304 (2,869,493); units sold for public lighting, 117,510 (57,220); average price per unit, private consumers, 3·00d. (3·35d.); revenue from sale of current to private consumers, £43,120 (£40,078); revenue from meter rentals, £2,873 (£2,742); revenue from public street lighting, £1,267 (£661); total revenue from all sources, £48,356 (£44,104); expenditure on revenue account, £20,7 3 (£20,895). Mr. Seabrook goes on to say that although the September quarter is a lower revenue-earning period than the June quarter, the increase in the balance available on September 30th for capital and special charges had advanced from £1,909 to £4,434. As the estimates for the current year were based on the assumption of an increase in available balance of £6,786 for the year, and the six months to date, represent about 34 per cent. on the annual output, they might look forward with confidence to a marked betterment on the year's estimate, even after meeting the whole cost of sundry expenditure of a capital nature.

Battersea.—Application is to be made to the L.C.C. for sanction to the borrowing of £4,500 for mains and services.

The E.L. Committee has withdrawn its application for a loan of £5,362, for mains, &c., for public and private lighting on the Battersea Rise House Estate.

In a statement of the work carried out by direct labour during the six months ended March 31st, 1909, submitted by the various Committees of the L.C.C., some 50 items of an electrical nature

appear, mainly in connection with the maintenance or installation of electric light or telephones.

Mexico.—According to the *Mexican Herald*, the Chapala Hydro Electric and Irrigation Co., headed by Messrs. Fernando Pimental & Fagoaga, of Mexico City, will shortly carry out a scheme for the transmission of electrical power to the Aguascalientes district from the Santiago River. The company will probably install a large power plant at Las Juntas, and construct a canal from the Juanacatlan Falls to that place, a distance of 26 km. (about 16 miles). At Las Juntas the head of water would be sufficient for the generation of 90,000 H.P.

Neston.—The U.D.C. has approved of a licence applied for by Sir Alfred Jones and Mr. O. H. Williams for an electricity scheme for the district.

Penmaenmawr.—The District Council proposes to light the Promenade with electricity, and the work will probably be taken in hand in the early spring.

St. Anne's.—Instructions have been given that all meter readers and other workmen who have occasion to enter electricity consumers' premises must wear a distinctive badge.

Saltcoats.—The application of Mr. George Balfour to the Board of Trade for a prov. order to supply electricity for lighting purposes within an area of supply including the burgh of Saltcoats, has received the consent of the Town Council. The district which the order covers is Ardrossan, Saltcoats and Stevenston.

Surbiton.—The L.G.B. has sanctioned the raising of a loan of £2,191 for additional machinery at the generating station.

Swindon.—The T.C. has adopted a supplemental assisted wiring scheme for the wiring of consumers' own premises, where the cost of the installation will not exceed £10. The consumer will repay by an extra charge for energy.

Stockton Heath.—The Council has decided to approach Warrington T.C. with reference to a supply of electricity. The parish is scheduled in the application of the Salt Union for a prov. order for E.L., but the Council prefers to have a supply from Warrington.

Taunton.—At a meeting of the T.C. recently a discussion took place on what Councillor Alms described as the indictment made by the Chamber of Commerce as to the manner in which the accounts of the electricity department were kept. The town clerk replied that the accounts were kept in accordance with the requirements of the L.G.B., and the Council had invited the Chamber of Commerce either to inspect the accounts for themselves, or to ask the L.G.B. to hold an inquiry. A communication has been sent to the Board as to an inquiry by the Chamber of Commerce.

Torquay.—The electrical engineer reports that in spite of the increased use of metallic-filament lamps, the output for lighting purposes has been maintained. The position of the works to deal with the lighting demand is much better now than last year, as the whole of the alternating-current plant is available for lighting purposes, whereas last year it was liable to be called upon at any time to supply power for traction.

Whitchurch.—The U.D.C. has decided to ascertain if any company will undertake an installation for electrical street lighting.

Widnes.—The T.C. has decided to transfer the E.L. Order to the Salt Union, Ltd.

TRAMWAY and RAILWAY NOTES.

Ardrossan and Saltcoats.—The Saltcoats T.C. has received and considered a communication from Mr. A. W. Tait, one of the promoters of the Ardrossan and Saltcoats Tramways Order, stating that he has secured the co-operation of Mr. Balfour, who was applying for the lighting orders in the district, and that as soon as these orders were obtained, the construction of the tramways would be proceeded with. While it was not proposed to begin the construction of the first section until after the New Year, arrangements will be made to have the lines in Saltcoats and Ardrossan burghs in operation within the period mentioned in the order.

Argentina.—It is expected that the first section of the La Plata tramways will be in service in the New Year, and the remaining five sections at three months' intervals.

Canada.—Application has been made for the incorporation of a company to build an electric railway from Port Hope to Toronto, with branches and lines south to Lake Ontario. The new company is to have $1,000,000 capital, mostly raised locally.

A large deputation of representative men from New Brunswick and Quebec waited on the Government Railway Commission recently to discuss the proposal that the Grand Trunk Pacific Railway, now near completion, should operate its trains through the New Brunswick forest region by electricity generated at Grand Falls on the St. John River. This matter was discussed in the New Brunswick Legislature last year, the plan being suggested as a means of protecting the valuable lumber areas from fire.

The Montreal Street Railway Co. is about to commence the erection of new shops in the northern part of the city, costing $1,000,000.

It is announced that the British Columbia Electric Railway is to erect a 20,000-H.P. steam auxiliary plant in Vancouver.

Cardiff.—The city treasurer has issued a report dealing with the question of tramways depreciation. He states that the capital expenditure on March 31st, 1909, reached £768,088, which is equivalent to £24,138 per mile of single track, or about double what is usually found. The report refers particularly to the track, for which the loan period is 30 years, but which, in the opinion of the city engineer, will not average more than 15 years' life, or up to 1917. The tramways department possesses a nucleus depreciation fund of £28,957, which will go towards meeting the estimated sum of £89,320 required by the city engineer for track renewals by 1917. Under these circumstances, the city treasurer considers it imperative that the sum of £6,604 shall be set aside annually until the year mentioned. The city engineer's estimates, however, contemplate further renewals in 1920 (£14,000), 1922 (£19,320), 1926 (£36 320), and 1932 (£58,720), and neglecting the latter sum, which could be re borrowed owing to the expiration of the original loan, the treasurer estimates that an annual sum of £6,946 would be required for depreciation up to March, 1926. It remains for the Committee to decide whether the present system of renewing cars, overhead work, cables, and other plant is sufficient to ensure a life long enough to dispense with depreciation in those sections.

Colwyn Bay.—By order of the Light Railway Commissioners, an inquiry was held on Saturday, December 18th, relative to the proposed extension of the electric railway from the present authorised terminus at Gross Bridge, to the Queen's Hotel, Old Colwyn. The promoters, the Llandudno and Colwyn Bay Electric Railway Co., were represented by Mr. Sellon (chairman of the board). Col. Boughey, R.E., presided. It seems that after the hearing on November 6th, 1907, the Commissioners decided that the Abergele Road, along which it was proposed to lay the railway, should be widened at various places, but the further proceedings were adjourned in order to see if reasonable arrangements could be made for the widening. In the meantime the parties had been unable to come to terms.

For the District Council, it was stated by Mr. Amphlett, that every effort had been made to come to terms with the company, but they had failed, for the reason that the promoters endeavoured to put upon the Council the onus of acquiring the land needed for widening purposes. The Council had already spent £600 on account of widening between the present terminus and Gross Bridge, and it had been paid £383 on account, but the company, through Mr. Sellon, now threatened not to construct another yard of the line, and so deprive the Council of the £3,000 due under an agreement with the company.

Mr. Sellon said the case was that the company preferred to construct the railway right through to Old Colwyn at one operation. The line had been stopped by the Board of Trade at Gross Bridge. The company was quite willing and ready to make a contribution towards the cost of land, such as it could afford, but it was no part of his duty to agree to construct a line which meant bankruptcy as far as that scheme was concerned. It was a monstrous proposal that they should make a 30-ft. wide roadway and provide a 9-ft. wide footpath in addition.

The Chairman said that as unfortunately the parties had not agreed, the Commissioners had to decide what conditions should be imposed before the line could be sanctioned. They were satisfied that the extension would not bear anything on account of general public improvements, and they had therefore decided to grant an order in which a condition would be inserted that where any land could be obtained at a reasonable cost the company should be required to acquire such an amount as would widen the road to 24 ft., plus replacing the footpath where any existed, and plus a 6-ft. footpath where none existed before. The company was not to be compelled to buy any houses. Narrow places would have to be passed under the double-line system, subject to any B of T. restrictions as to speed, &c. The Commissioners hoped that the conditions now laid down would enable the parties to come to a friendly agreement with the Council.

Continental Notes.—GERMANY.—The T.C. of Bonn is considering a scheme for the conversion to electric working of the existing steam tramway running between Bonn, Godesberg and Mehlem. The cost is estimated at 1,750,000 M., to be borne in equal amounts by the T.C.'s of Bonn and Godesberg.

The good results, technical and economic, obtained by the State Railway Administration from the working of accumulator locomotives, are likely to lead to their increased adoption. Of the 87 on order, the greater number have been delivered, and the balance is being completed as rapidly as the works will allow. The first 100 estimated to be required by the pressing traffic requirements will shortly be in service.

SWEDEN.—The Swedish engineer, Quitsgaard, has drafted an important scheme for the construction of an electric railway under the Baltic Sound. The new line will unite Malmö with Copenhagen, and be of a length of 230 kilometres, of which 16 will be formed by a tunnel excavated under the Sound which separates Sweden from Denmark. A Special Commission has been nominated by the Swedish Government to examine the scheme, and as soon as its decision is announced, which it is anticipated will be favourable, the Danish Government will join in a convention for the construction of the line.

Italy.—The Railway Administration has sanctioned the scheme for the construction of a central station at Vado, on the Ventimiglia-Savarne line, at an estimated cost of 1,500,000 lire.

Spain.—An application has been presented by the Compania Nacional de Tranvias, of Barcelona, for a concession for an electric tramway designed to join up Gárriga and Muntaner Streets, Barcelona.

An application has also been submitted for a concession for the construction and working of an electric tramway from Renteria to the French frontier *viâ* Irun and Behovia.

Turkey.—The permanent way of the Constantinople tramways, which belong to the Société des Tramways de Constantinople, has for a long time past been allowed to remain in an unsatisfactory condition, but in order to comply with the terms of the concession, the whole of the route is now being reconstructed at an expenditure of £200,000. A further outlay of £280,000, according to statements made in circles associated with the company, will be necessary to equip the lines for electric traction. The commercial prospects of the undertaking are not referred to favourably by a German correspondent, who also points out that the Ministerial Council has just granted a concession for the institution of a service of motor-omnibuses, which would prejudicially affect the receipts of the tramways.

Devonport.—The Devonport and District Tramway Co. restarted on Saturday a service on the leased lines of the Devonport Corporation. It will be remembered that the cars on these lines ceased running on January 17th last. The leased lines extend from Milehouse to Tor Lane, Camel's Head to St. Budeaux, and from the North Keyham Gates along St. Levan's Road to Milehouse.

East Ham.—£926 is to be spent in alterations to 15 cars, so that they may be used on the through route to Aldgate.

Glasgow.—Rapid progress is being made with the T.C.'s new tramway depôt at Newslandsfield. The building will be ready in the spring, and the plant, &c., transferred from the old depôt at Pollokshaws, which the extension of the cars to the south has rendered inconvenient. The Committee has now approved of plans for the extension of the depôt at Maryhill.

The Committee of Works and Stores has had under discussion, along with the general manager (Mr. Dalrymple), the question of providing protection for motormen on the driving platforms during inclement weather. Consideration has been adjourned in the meantime.

The general manager has reported to the Committee that the valuation for the year 1910-11 of the T.C.'s tramway undertaking, as valued by the Assessor of Railways and Canals, amounts to £258,918.

Leigh.—The electrical engineer is preparing a report for the members of the Tramways and Electricity Committee on the question of establishing a motor-'bus service.

London.—The L.C.C. Highways Committee states that the abortive expenditure on the Aldgate-Bow tramways, due to the discarding of the G.B. surface-contact system, is £25,265; this is to be charged against the reserve fund. The cost of reconstructing the above route on the combined conduit and trolley system has amounted to £110,849; had the lines been constructed in the first instance on the conduit-trolley system, the cost would have been £86,530.

Owing to the increasing competition of the electric tramways and motor-'buses, the Great Eastern Railway has decided to extend its policy of fare reductions over a still wider area than originally introduced in March, July and November of this year.

Lowestoft.—The T.C. has agreed to reduce the price of energy for traction to 1½d. per unit, the reduction to date from October 1st last and to continue to September 30th next. The Tramways Committee must agree to take a minimum consumption of the same number of units as last year. The reduction is also subject to the price of coal not being increased in the 12 months. Should either of these factors be altered to the detriment of the electricity undertaking, the charge is to be reconsidered.

Middlesbrough.—The town clerk has reported to the T.C. that the Act of 1904, empowering the tramway company to extend the tramways to South Bank, Eston and Grangetown, has lapsed through the default of the company to carry out the work by August 15th.

Sandgate.—The Council has decided to assent to the S.E. & C. Railway Co. working the local tramway with petrol motor power, conditionally on its not prejudicially affecting the Council's rights under the Act of 1906.

Spen Valley.—Notice has been served on the Cleckheaton U.D.C. of a renewed application by the B.E.T. Co. for a cessor of powers in reference to a projected tramway between Cleckheaton and Hightown Heights, Liversedge, which was included in a previous scheme. The U.D.C. has appointed a sub-committee to go into the matter, the feeling being that the line should not be abandoned.

Middlesex.—At the meeting of the County Council on December 16th, the Tramways Committee submitted the annual report. The total length of lines authorised was 43 miles 1 furlong 7·85 chains, of which up to March 31st last, 30 miles 6·7 chains had been constructed and opened for public traffic. The contract price for several of the tramways had been exceeded, chiefly because extra concrete was required to secure good foundations for the track work and roadway. The Metropolitan Electric Tramways, Ltd., during the year ended March 31st last, expended £42,506 on the tramways, the chief items of which were: cables, £15,778; rolling stock, £15,778; overhead equipment, £5,491; and buildings, £2,730. The company's total expenditure up to December 31st last on the tramways was £274,743. The approximate amount of the capital expenditure of the County Council on tramways amounted up to March 31st last to £1,518,197. This figure is arrived at after crediting the amounts received from the sale of surplus properties. The amount reserved by the company in respect of the reconstruction and renewals fund to date, and charged in the revenue account, amounted to £37,066. During the year ended December 31st, 1908, the traffic receipts were £304,747 or 11·497d. per car-mile, the figures for the preceding year being £244,445 and 11·828d. The working expenses during the 12 months under review were £190,601, or 7·191d. per car-mile, the figures for the preceding 12 months being £146,450 and 7·087d. The chief items making up the working expenses came out as follows per car-mile, the figures in parentheses being for the preceding year:—Running expenses, 2·778d. (2·834d.); power and purchase of energy, 1·973d. (1·969d.); repairs and maintenance, 1·231d. (1·061d.); rates, ·277d. (·328d.); rent of Highgate Archway tramway, ·093d. (·97d.); rent of Hertford Light Railways, ·091d. (—); insurance third party, ·321d. (·308d.); general expenses, ·427d. (·490d.). The car-mileage run was 6,361,253, as against 5,037,204 in the previous year; the passengers during the same periods were 57,369,307 and 48,242,404 respectively. The route-mileage in operation was 42⅜, as against 40¾ in the previous year.

Uruguay.—Mr. E. C. Steer has deposited a guarantee of $10,000 gold in relation to his proposal to build an electric railway from Monte Video to Colonia.

TELEGRAPH and TELEPHONE NOTES.

Cables Interrupted and Repaired.—Cape Hayti-Mole St. Nicholas repaired December 16th; Obok-Djibouti interrupted December 20th.

Telegraph Memorial.—The Bureau International de l'Union Télégraphique has issued the rules governing the tenders from artists of the world for the design and erection at Berne of the monument to commemorate the establishment of the Union, the total cost of which is not to exceed 170,000 fr. Expenses of Transport Customs, and in connection with foundations, will be met by the Federal Council. The conditions of tender have been approved by the Judging Committee, and designs, &c., must be delivered at the Palais Fédéral, Pavillon Central, Berne, by August 15th, 1910.

Wireless Telegraphy.—A dockyard draughtsman and wireless telegraph expert named Knowlden has been charged with stealing a wireless receiver from the Vernon wireless school at Portsmouth, where he was employed. The prisoner explained that he was taking the receiver home in order that he might study it.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Melbourne.—January 5th. One feed-water oil eliminator for the City Council. See "Official Notices" November 19th.

Melbourne.—February 2nd. Electrically-driven pump for the City Council. See "Official Notices" December 10th.

Melbourne.—February 22nd. The Postmaster-General is calling for tenders for the erection of wireless telegraph stations on North and South Heads, Sydney, and on Fremantle Heights, Western Australia, capable of communicating with ships up to 1,000 miles.

Canterbury.—March 16th. A branching multiple magneto switchboard for the P.M.G., for Canterbury, Victoria. Commonwealth Offices in London, 72, Victoria Street, S.W.

Sydney.—January 11th. A power generating station equipment for the Lithgow Small Arms Factory, New South Wales, for the Commonwealth. See "Official Notices" December 10th.

Sydney.—Two junction-line sections of common-battery switchboard for the P.M.G. See "Official Notices" to-day.

South Australia.—Telegraph and telephone material for the P.M.G. See "Official Notices" to-day.

Belfast.—January 10th. One 1,500-kw. continuous current turbo-generator and condensing plant for the Corporation. See "Official Notices" December 10th.

Belgium.—The municipal authorities of Grace-Berleur (province of Liége) are inviting tenders until the 27th inst. for the concession for the supply of electrical energy for the lighting of the municipal buildings and for private lighting purposes in the town.

Bridlington.—January 1st. 300-KW. steam dynamo for the Corporation. See "Official Notices" December 10th.

Brighton.—January 10th. One 3,000-KW. three-phase turbo-alternator, with condensing plant, &c.; one 1,300-H.P. 3,000-volt three-phase induction motor; one 300-KW. induction motor-driven balancing set; high-tension switchgear, &c., for the Council's North Road sub-station. See "Official Notices" to-day.

Dublin.—January 14th. Electric lighting scheme for the new Crooksling Sanatorium of the Dublin Joint Hospital Board. Patrick Nally, Clerk to the Board, Municipal Buildings, Cork Hill, Dublin.

Eccles.—January 15th. 150-KW. steam engine and D.C. dynamo for the Corporation electricity undertaking. See "Official Notices" to-day.

December 31st.—Electric light installation at the Beech Street Council School, Winton, now erecting, for the Corporation. Specification from the Town Clerk (10s. returnable).

Erith.—January 10th. High-tension three-phase alternating-current switchboard for the U.D.C. See "Official Notices" to-day.

Italy.—January 11th. The Ministry of Marine invites tenders for the supply of electric lamps and lampholders. The upset price is put at 150,000 lire (£6,000), and 10 per cent. of this sum will be required as a deposit to qualify any tender. Tenders to the "Ministero della Marina," Rome.

London.—I.E.E.—January 10th. The Council of the Institution of Electrical Engineers is inviting tenders for the interior wiring and fittings for lighting and power at its new premises. See "Official Notices" to-day.

Spain.—The municipal authorities of Albesa (province of Lerida) have just invited tenders for the concession for the electric lighting of the town during a period of 25 years.

CLOSED.

Admiralty.—Messrs. Smith, Major & Stevens, Ltd., have just been instructed by the Lords Commissioners, of the Admiralty to supply and erect on board the Dreadnought Battleship, H.M.S. *Neptune*, four of their electric passenger lifts, the order having been obtained after an exhaustive inquiry into the merits of the lifts in question.

Cape Town.—The Cape Government Railway has accepted the tender of Messrs. R. B. Hendry & Co., of Cape Town, for five 20-H.P. electric motors, at £61 8s. 6d. each, and three 15-H.P. electric motors, £49 17s. 6d. each, delivered ex ship's slings, Algoa Bay.

The tender of Messrs. E. A. Shaw & Co., of Cape Town, has been accepted for the electric lighting of Messrs. Hepworth's premises. The installation will comprise flame arc lamps outside, 300-C.P. Osram lamps in the shop and 32-C.P. Osram lamps in the windows.

Edmonton.—In connection with the Edmonton Union electric light and power installation, the Guardians have accepted the tender of the Edison & Swan United Electric Light Co., at £575, for cables and switchboard, this being the lowest tender for British manufactures. By a special resolution the Guardians decided to give the preference to British cables which, it is understood, involved an extra of about 10 per cent. over the prices for foreign cables.

Government Contracts.—The following tenders have been accepted by the Government Departments named:—

WAR OFFICE.

Electric light fittings, lamps, &c.—Armorduct Manufacturing Co., Ltd.; Barton & Sons, Ltd.; Credenda Conduits Co.; Foote & Milne, Ltd.; General Electric Co., Ltd.; Nettlefold & Sons, Ltd.; Perfecta Seamless Steel Tube and Conduit Co., Ltd.; Edison & Swan United Electric Light Co., Ltd.; Spagnoletti, Ltd.

GENERAL POST OFFICE.

Bell sets.—British Insulated and Helsby Cables, Ltd.
Cable, india-rubber and cotton-covd.—Callender's Cable & Construction Co., Ltd.; Henley's Telegraph Works Co., Ltd.
Cable, paper-covd.—British Insulated and Helsby Cables, Ltd.; Western Electric Co.
Insulators.—Doulton & Co., Ltd.

Glasgow.—The Tramways Committee has recommended that the T.C. accept the following:—

Special track work, Newlandsfield Depôt.—Hadfield's Steel Foundry Co., Ltd.
Gear cases.—British Westinghouse Electrical and Manufacturing Co., Ltd.
Trolley wheel bushes.—Fleming, Birkby, & Goodall, Ltd.
Heating, Newlandsfield Depôt.—Jas. Cormack & Son, Ltd.
Portable crane.—Butters Bros. & Co.
Car brake chains.—Weldless Chains, Ltd.; D. Watson & Co.
Armature coils.—British Westinghouse Electrical and Manufacturing Co., Ltd.
Mica.—Geo. Schultz & Co.; Micanite and Insulators Co., Ltd.
Vertical boiler.—Muir & Findlay.

Hungary.—Messrs. Ganz & Co., of Budapest, have secured a contract for the establishment of a municipal central electric lighting station in the town of Orsova.

Hyde.—The T.C. has accepted the tender of Messrs. Russell & Sons for the E.L. and motive power installation at the Town Yard.

Italy.—The Italian Post and Telegraph authorities in Rome have just placed a contract with Messrs. Richard Johnson and Nephew, of Manchester, for the supply of 110 tons of galvanised iron wire.

Hindhead (Surrey).—The following is an analysis of tenders received for cables, feeder pillars, and all accessories for the high-tension extension of the Hindhead Electric Light Co. Messrs. Handcock & Dykes, of Westminster, are the consulting engineers:—

	Amount of tender.	Extra if oil-break switches.	Amount of tender with oil-break switches.
Callender's Cable and Construction Co., Ltd.	£4,885	£74	£4,959
British Insulated and Helsby Cables, Ltd.	4,776	29	4,805
Henley's Telegraph Works Co., Ltd.	4,753	55	4,808
Siemens Bros. & Co., Ltd. (accepted)	4,669	64	4,733

For the Diesel engine, alternator, and all fittings and attachments, and motor-alternators, switchgear, cables and connections complete, the following were the tenders:—

Contractors.	Engine.	Alternator.	Total.	R.P.M.
Ferranti, Ltd.	Mirrlees	Not stated	£2,322	214
Diesel Engine Co.	"	E.C.C.	2,445	214
Electric Construction Co. Mirrlees, Bickerton & Day	"	"	2,462*	200
	"	"	2,475*	200
Brit. Thomson-Houston Co.	"	B.T.-H.	2,507	200
Brush Elecl. Eng. Co.	"	Brush	2,520	200
Brit. Thomson-Houston Co.	"	B.T.-H.	2,531	200
Mirrlees, Bickerton & Day	"	Brush	2,532	200
Mirrlees, Bickerton & Day	"	G.E.C.	2,542	200
Siemens Bros. & Co.	"	Siemens	2,552	200
Mirrlees, Bickerton & Day	"	B.T.-H.	2,567	200
British Westinghouse Co.	"	B. West.	2,583	200
Electric Construction Co.	Sulzer	E.C.C.	2,587	214
Mirrlees, Bickerton & Day	Mirrlees	Siemens	2,597	200
Diesel Engine Co.	Sulzer	E.C.C.	2,603	200 or 214
Brit. Thomson-Houston Co.	"	B.T.-H.	2,632	214
Brit. Thomson-Houston Co.	"	"	2,656	214
Siemens Bros. & Co.	"	Siemens	2,696	214
Diesel Engine Co.	"	E.C.C.	2,716	—
Dick, Kerr & Co.	Mirrlees	Dick, Kerr	2,744†	200
Dick, Kerr & Co.	Sulzer	"	2,877†	214

* Accepted. † Incomplete, excludes 10-KW. motor-alternator.

London.—WANDSWORTH.—The Guardians some time ago appointed Mr. E. R. Dolby, M.I.C.E., M.I.Mech.E. (Dolby and Williamson), of Westminster, as consulting engineer for the installation of the heating and hot water service and boiler house plant in their new Infirmary. The L.G.B. approved the engineering scheme, and from among the tenders obtained from seven firms of contractors, the lowest tender, that of Messrs. Moorwood, Sons and Co., Ltd., of Sheffield and London, was accepted.

L.C.C.—The following tenders were received for roadwork and platelaying, exclusive of supply of rails and special trackwork, in connection with the reconstruction, on the underground conduit system, of the tramways from Rainton Road to Chapel Street, Woolwich, and Farringdon Road:—

	Tramway works.	Retaining walls, &c., for street widenings.	Total.
Dick, Kerr & Co. (accepted)	£40,210	£588	£40,798
John Mowlem & Co.	40,449	598	41,047
W. Manders	43,620	646	44,266
R. C. Brebner & Co.	44,273	675	44,948
G. Percy Trentham	46,057	600	46,657

Messrs. Dick, Kerr will sublet certain portions of the work as follows:—Yokes, Anderston Foundry Co., or Wilsons, Pease & Co.; insulators, Doulton & Co. or Bullers; tie-bars, bolts, &c., to Bayliss, Jones & Bayliss or Guest, Keen & Nettlefolds; cement, Associated Portland Cement Manufacturers (1910), Ltd.; plough boxes and drain boxes, Harrison & Co. (Lincoln), Ltd., or Hadfield's Steel Foundry Co.; bonds, Forest City Electric Co.

In connection with the electrification on the overhead trolley system of the Woolwich to Eltham tramways, the tenders are as follows:—

Alex. Stark & Sons (accepted)	£32,528	Kirk & Randall	£38,331
Dick, Kerr & Co.	33,296	W. Manders	40,040
Robert W. Blackwell & Co.	36,663	William Griffiths & Co.	40,191
John Mowlem & Co.	36,775	Daniel T. Jackson	40,197
R. C. Brebner & Co.	37,332	G. Percy Trentham	42,455

Messrs. Stark will sublet the tie-bars, bolts, &c., to Bayliss, Jones and Bayliss; and the drain boxes to Hadfield's Steel Foundry Co.

For the overhead electrical equipment for the Woolwich-Eltham line the tenders received were:—

British Insulated & Helsby Cables	(accepted)	£5,760
S. G. Smith		5,810
R. W. Blackwell & Co.		5,901
Dick, Kerr & Co.		5,909
National Electric Construction Co.		6,056

The British Insulated and Helsby Cables will sublet as follows:—Poles, Jas. Russell & Sons; bases, collars and finials, R. A. Bradshaw and Sons; brackets, Naylor Bros.

For special trackwork on the same section the tenders are:—

Hadfield's Steel Foundry Co.	(accepted)	£114
Edgar Allen & Co.		122

Twenty movable platforms required for the cleaning of electric cars at the Abbey Wood tramway car-shed are to be supplied by Messrs. G. Hayward & Co.

Messrs. Buck & Hickman are to supply an electrically-driven power hammer for the Greenwich generating station, at £206.

The Stores Committee has recommended for acceptance tenders from the following firms for electric fittings:—Dorman & Smith; Edison & Swan United Electric Light Co.; Elco Recording Press; General Electric Co.; A. P. Lundberg & Son; Nettlefolds & Sons, Ltd.; Perfecta Seamless Steel Tube & Conduit Co.; Siemens Bros.

and Co.; Siemens Bros. Dynamo Works, Ltd.; G. Straus & Co.; Veritys, Ltd.; W. White & Co.

The tender of George MacLellan & Co., of Glasgow, for electric insulating materials is recommended; and those of W. B. Dick and Co., and Ragosine & Co., for lubricating and lighting oils.

Lowestoft.—The T.C. has accepted the following tenders:—

Electric Construction Co, balancers, £105; Drake & Gorham, annual supply of lamps; Aubert Grenier & Co., annual supply of service cables; Elliott Bros.

ELECTRICAL (?) FIRES.

Following closely upon the disastrous fire at Clapham Junction, to which we refer in our leading columns, come two others, fortunately unattended by loss of life, but entailing the destruction of much valuable property—and all, as usual, have been attributed to electricity by the daily Press, which appears to have a standing order to follow this course. Regarding the Bute Hydro we have as yet no reliable information; but as we go to Press we learn, on good authority, that the destruction of the Pavilion could not possibly be due to electricity, for the main switch at the entrance to the pier was off. It is most unfair that, without a particle of evidence to go upon, the blame is always cast upon electricity in the first instance.

NOTES.

Use of Electricity in Mines.—The Council of the Institution of Electrical Engineers are considering the evidence to be submitted to the Home Office in connection with the inquiry on the use of electricity in mines. The secretary of the Institution will be glad to receive in writing on or before January 10th next any observations which members may wish to make on the Special Rules of the Home Office for the Installation and Use of Electricity (Coal Mines Regulation Act, 1887), now in force.

Arc Lamp Patents.—With reference to the note entitled "German Patent Cancelled," appearing on p. 984 of our last issue, a wrong impression is conveyed by the information given to us by the Regina Arc Lamp Works, of Cologne. The patent in question is not a fundamental one, and it was declared invalid because one of the English patents was regarded as prior publication. An appeal has been lodged.

The Anglo-Japanese Exhibition.—As an illustration of the interest that is being shown in Japan in next year's exhibition at Shepherd's Bush, it is stated in a Reuter dispatch from Tokio that the private exhibitors number 1,180, and their exhibits about 18,000. The actual transportation of exhibits was to commence on December 8th.

The Penalty Ought to be Greater.—At the Chatterley Whitfield Colliery on Thursday last week, Thos. Smith, a pit-hold youth, was filled with a desire to experiment with the electric current, and obtained a wire, which he inserted into the electric junction box, holding it by means of his cap. A short circuit resulted, the current in that district was cut off and the dip pump was stopped. At the Tunstall Police Court Smith was fined 10s. and costs. The manager told the Court that the pressure amounted to 500 volts, and had it not been for the fact that the lad insulated the wire with his cap he would have received a serious, if not a fatal, hock.

Dinner.—The annual dinner of the Electrical Engineers (London Division) was held at the Café Monico, on Saturday, December 18th. Col. R. E. Crompton, C.B., occupied the chair, supported by Brigadier-Gen. F. Rainsford Hannay, Major H. M. Leaf, and Dr. Gisbert Kapp. The hall was comfortably filled with the officers, non commissioned officers and men, to the number of over 200, the absentees being principally men at present on service, and the String Band of the Royal Engineers rendered an excellent musical programme. The toasts were few, and the speeches brief. Col. Crompton proposing "The Imperial Forces," posed as a man of peace, and in that capacity called for preparedness for war as the surest means of securing the continuance of peace. Brigadier-Gen. Rainsford Hannay, in responding, notified to the usefulness of the Corps as Volunteers in South Africa, and hoped that army changes would not decrease that usefulness or diminish the numbers of the Corps. The remaining toast, "Science and Engineering," was proposed briefly by Major Leaf, and responded to by Dr. Kapp and Major Dumbell, the late Adjutant, who has now gone over to the London General Omnibus Co., to which fact he made jocular allusion. The proceedings terminated with hearty cheers for Col. Crompton, whose popularity was evident.

Institution and Lecture Notes.—The Tramways and Light Railways Association.—As from December 25th the offices of this Association will be at Caxton House, Westminster, S.W.

Institution of Electrical Engineers, Newcastle-on-Tyne.—The annual dinner of the Newcastle-on-Tyne Local Section was held on the 15th inst. at Newcastle, Dr. H. Stroud, the chairman, presided.—Prof. L. Weighton, in proposing the toast "The Institution of Electrical Engineers," said he believed practical applied electricity had had a great effect on the older branches of engineering, and upon constructive engineering generally. Economy in the use of steam was very much due to the requirements of the electrical engineer, and the steam turbine itself owed its origin very largely to his needs. Its first obvious purpose was to generate the electrical current for which it was so clearly adapted, but since it had been applied to marine engineering there was a promise in the future that the gross propulsive efficiency of steamships propelled by turbines might be considerably increased by connecting the high-speed turbine with the comparatively slow reciprocating engine.—Prof. Kapp, responding, said that electricians owed a great deal to the mechanical engineer. Electrical engineering was only mechanical engineering with a little bit of electricity grafted on. But the grafting on had been a most successful process. They were fortunate in Newcastle in having electricity supplied to them at a lower price than anywhere else. In Italy, where he was lately, the price was 8d. or 9d. per unit, while in the City of Newcastle it was only 2d. per unit. That result had been brought about because they had men there who knew how science should be applied, and the world had been specially indebted to that city for the men it had brought forward. The application of electricity had completely changed the character of industry. There were indications of an improvement in trade, and there was no doubt that with the great practical advantages, which had been demonstrated up to the hilt in that district, of electric driving and electrical processes generally, the movement for the spread of electricity would advance.—The chairman also responded to the toast.

Huddersfield Society of Engineers.—Mr. A. W. Bennis recently gave an address to the Society on "Modern Developments in Mechanical Stokers," including an account of the new patent balanced double shovel arm introduced to the well-known "Bennis" sprinkling stoker. One of the advantages of this new adaptation is that the shovel arm can be instantly detached without the removal of the shaft, which has hitherto been necessary in actual operation. He also dealt with coking stokers, and gave a number of instances of their adoption resulting in improved efficiency and the abolition of smoke nuisance.

Electric Time Service.—We are informed that the system in use at Portsmouth, referred to in our "Notes" last week, is that of the Magneta Time Co., of which a preliminary installation has been in successful operation for the past seven months.

Appointments Vacant.—Junior assistant, to take shift at Hastingden tramways sub-station (15s.); assistant engineer, for Leek U.D.C. electricity department (£100); instructor in electrical wiring for the Walthamstow Higher Education Committee. See "Official Notices" to-day.

Electric Shock Fatalities.—According to news received from South Africa, it appears that Mr. Bantjes, who had been engaged for some time on Witbank colliery as assistant electrician on some electrical work underground, met his death by coming in contact with a 500-volt wire.

While a machine-man was attending to one of the coal-cutting machines in the Hartley seam of No. 2 pit at Millwall, Stirling, he came in contact with a live wire and was instantly killed.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Morecambe Corporation have appointed Mr. Lionel B. Hogarth, assistant engineer, Bermondsey Electricity Works, as resident borough electrical engineer. Mr. Cragg, third engineer-in-charge, has been promoted to the vacant position at Bermondsey, at £120 per annum. Mr. Ingham, junior engineer and switchboard attendant, will take Mr. Cragg's place at £110, and a junior engineer-in-charge and switchboard attendant is to be appointed.

Mr. W. H. Miller, chief assistant electrical engineer at Wakefield, has been appointed electrical engineer to the Fleetwood U.D.C. Mr. Miller had been five years at Wakefield, and prior to that he was for nine years at Belfast. He is a native of Fleetwood.

Mr. W. P. Hooper, who has resigned his position as shift engineer at the Eccles Corporation Electricity Works in order to take up another appointment under the Doncaster Corporation, was recently presented by his colleagues with a dressing case.

Mr. Tylecote, assistant electrical engineer at Llandudno, has resigned. The U.D.C. has appointed Mr. Daniel Hughes, second assistant, to be assistant engineer.

Tramway Officials.—The staff of the Wakefield and District Light Railway Co. have presented a timepiece to Mr. C. J. Stewart, engineer at Castleford, on his marriage.

General.—The Waterloo U.D.C. has appointed Mr. Wm. Shaw, of Waterloo, as electric inspector for the district under the Great Crosby and Waterloo E.L. Order, 1896, at a fee of 5s. for each test, to be paid by the consumer.

Mr. H. T. Wilkinson has resigned his position as assistant manager of the Chloride Electrical Storage Co., Ltd., and has joined the Wardle Engineering Co., Ltd., of Manchester, as managing director, conjointly with Mr. C. H. K. Chamen.

Obituary.—We regret to learn of the death from pneumonia, on December 10th, at Loughton, Essex, of Mr. Frank L. Rowe, for many years manager of the Edwards Air Pump Syndicate, Ltd.

CITY NOTES.

Melbourne Electric Supply Co., Ltd.

Mr. J. B. Braithwaite (chairman) presided on Monday at the offices, Finsbury Pavement House, E.C., over the tenth annual general meeting of the above company.

The Chairman, in proposing the adoption of the report (see Elec. Rev., December 17th), said his task was a more pleasant one than on any previous occasion. They had had many years of adversity, but this year it seemed as if they had at last emerged into daylight. The balance-sheet presented some very important changes since last year. On the debit side of the account, whilst the authorised capital remained the same, there was a fresh item under issued capital which was owing to the issue of 20,000 7 per cent. first cumulative preference shares of £5 each, which brought in £99,855. The old 6 per cent. preference stock and the ordinary stock remained the same, but the 5 per cent. first mortgage debenture stock had been increased by £100,000. The result of the reorganisation of the capital account had been that they had been enabled to wipe out the heavy loans which had been such an incubus in the last few years. Last year they had loans against security and bills payable amounting to £150,804. That item had now disappeared, and in its stead they had cash at banker's and in hand amounting to £14,966. On the credit side the expenditure on the Melbourne undertaking had gone from £298,356 to £321,163, and at Geelong from £56,216 to £57,993. Their Adelaide ordinary shares had been reduced in number because they had sold a certain number of them in order to create a market for them in Adelaide. To make that market they had to begin selling a few shares at a discount, and the total result of the sale had been a loss of about £1,000, which they had written off. The price of the shares was now par, and recently there had been a bid at a slight premium for them, so that the policy had been entirely successful, and the asset in the balance-sheet represented by Adelaide ordinary shares might be taken as equivalent to cost. This had warranted them in transferring £11,750 out of their reserve account, which represented part of the profit they made in paper on the formation of the Adelaide Co., to the reduction of the suspense account. The suspense had been increased very largely by the cost of obtaining the fresh capital. They would understand that, in the condition in which the company was they were unable to obtain the same terms that a company of high credit would have done. They had to pay (and it was worth paying for) for having the capital account reorganised, and the whole cost was £19,358, in addition to stamp duty and a payment of £3,434 to the Debenture Corporation, Ltd.—a total of £22,789. They wanted to extinguish the item as quickly as possible, and they had transferred the sum of £11,500, which reduced it to £11,039, and they proposed to write off out of revenue a further £2,039, leaving them an even amount of £9,000, which they proposed to extinguish in three annual payments of £3,000 each. Turning to the separate accounts, the result of their operations in Melbourne had been to earn £20,573 13s. 4d., instead of £16 053 last year, and that increase of profit had been distributed over every branch of the business. The revenue from lighting had risen from £19,688 to £22,878; from power, from £8,685 to £10,090; and from public lighting, from £3,154 to £3,253; so that the total revenue had advanced from £31,528 to £36,222. There had been a corresponding increase in the minor items of revenue, and the total income was £37,494 9s. 11d. On the other side the generation of electricity had cost £6,579, against £9,129, so that they had done more business at a reduced cost of between £500 and £600. That was due mainly to having their new turbine in operation. The cost of distribution was slightly lower, but repairs and renewals were slightly up. The net result was that they had £4,523 from Melbourne, as compared with last year. At Geelong they had the same thing on a smaller scale, and taking the two together, they had an increased profit of £5,339. In addition to this, the Adelaide undertaking had given them a greater return, and they had received £6,666 from that source, against £4,239 last year. The result was that after paying interest on debentures, and on sundry loans, directors' fees, &c., they had an available balance of £13,469, against £5,288 last year. There were various items they were providing for this year, which would not recur. There were special charges, including legal expenses, and a fee of £210 to two directors for special services in connection with the raising of the new capital, which amounted to £978; the cost of guaranteeing the loan which they had to raise pending the creation of the new capital, £503, and the loss on the shares of the Adelaide undertaking, £1,037. The result was that they carried to the general balance £12,721, as against £1,771. They proposed to pay the full dividend on the new 7 per cent. preference shares, amounting to £1,821 10s. 6d.; to transfer to the depreciation and general reserve account £5,193 17s. 6d. (which would make this account an even figure of £12,000); to write down the suspense account by £2,039; to write down the head office furniture by £42 13s. 1d.; and carry forward £3,694 9s. 3d., which approximately represented the half-year's dividend on the 100,000 7 per cent. preference shares, which they had recently issued, and which would be due on March 1st next. They believed this disposition of their surplus to be sound and conservative. The Chairman proceeded to read the figures of the progress of the undertaking, which are set out in detail in the annual report, and said they had reason to feel satisfied with the prospects both at Melbourne and Geelong, whilst at Adelaide they were doing extremely well. As regarded the old preference shares the board was sorry that they just failed to obtain the three-fourths majority to carry the proposal for finding the arrears of interest and putting them on a dividend-paying basis, but the matter was still receiving their serious consideration, and they hoped to put the same proposals, or slightly amended proposals, before the shareholders in the new year.

Mr. D. Findlayson seconded the motion for the adoption of the report.

A Shareholder pointed out that no reference had been made to the item of £2,727 for carbon and lamp renewals appearing in the Melbourne accounts.

The Chairman said they supplied carbons to their customers as part of their method of doing business.

Mr. Tuckett congratulated the board on the improved position, but asked his fellow-shareholders not to be too eager to divide profits before proper provision was made for depreciation and renewals. Whilst he was anxious to see a dividend, yet a premature declaration might mean losing profits in the long run.

The Chairman said the board were fully conscious of this point, but it would be satisfactory to shareholders to remember that the Melbourne station was equipped with turbine machinery which was most economical in operation, and, so far as they knew, the least liable to obsolescence. In addition, most of their lines were overhead, and were not so liable to depreciation in one sense, although the cost of maintenance might be greater.

Mr. R. P. Sellon said that where lines were laid underground experience had shown that provision must be made for depreciation. The electrical supply industry was not a great age, but experience had shown that india-rubber, which was thought at the beginning to be the right insulating material for copper, had had to be almost entirely replaced by paper; so that where they had a large system of underground mains provision must be made for not merely keeping them in order, but for obsolescence—to provide for the contingency that at some future time a new insulating material would be found. At Melbourne a large proportion of their mains were overhead, and it was not necessary to make the same provision. He might say, however, that this question of depreciation was receiving the very careful consideration of the board, and they hoped very shortly to have their managing engineer, Mr. Clements, over here, and it was the intention of the board to review the whole subject with his assistance.

The report was then adopted.

On the motion of Mr. J. F. Albright, seconded by Mr. W. Parker, the retiring directors, Mr. D. Finlayson and Mr. R. Percy Sellon, were re-elected directors.

Mr. Sellon, in reply, said he had been associated with the company for many years, during which period they had had great difficulty and anxiety. He was sure there was sound ground for hoping that they had now definitely turned the corner and were entering upon a period of steadily increasing prosperity.

On the motion of the Chairman a hearty vote of thanks was passed to the engineer and manager, Mr. Clements, and the staff in Australia for their loyal services to the company.

United River Plate Telephone Co., Ltd.—The directors have declared an interim dividend at the rate of 6 per cent. per annum (3s. per share) on the ordinary shares for the half-year.

Telephone Company of Egypt, Ltd.—The register of transfers of 4½ per cent. redeemable debenture stock is closed from December 18th to 31st inst., both days inclusive, for the preparation of warrants for the half-yearly interest due January 1st, 1910.

Barbados Telephone Co.—At the recent half-yearly meeting the accounts for six months to September 30th, 1909, were presented. The Hon. W. K. Chandler was in the chair, and said that the number of instruments in use was a record one—716. He had pleasure in recommending a dividend of 4 per cent. Construction account had been reduced by $321. Their poles already carried so many wires that it was necessary to place intermediate poles, and £200-£300 was spent in this way. Rental of instruments produced $9,522, while the total revenue was $9,805, and the expenditure $6,050. The dividend would absorb $3,072, and $39 was carried forward. The dividend and accounts were passed.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the four weeks ended November 26th, 1909, were 561,567, compared with 358,911 units in the corresponding four weeks of 1908.

Isle of Thanet Electric Tramways and Lighting Co., Ltd.

The ordinary general meeting of the shareholders of this company was held on Thursday last week at Winchester House, Old Broad Street, E.C., Lord Arthur Butler presiding.

The Chairman, in moving the adoption of the report, said he thought he might fairly congratulate the shareholders on the substantial improvement in the position of the company which the accounts disclosed. The profits amounted to £15,053, being the best results yet attained, and an increase of £1,663 over the previous year. The improvement in the profits was due both to increased receipts and reduced expenditure. The revenue from tramway traffic showed an increase of £656, as compared with 1908, and he thought it was a most satisfactory feature that the increase was not due to exceptionally good weather during last season. The weather conditions were, in fact, exceptionally bad, especially during the August Bank Holidays, when they dropped £300 in their receipts compared to the same Bank Holidays in 1908. The revenue from the sale of light and power also showed an increase of £398, equivalent to 10 per cent. in one year. That they might also look upon with satisfaction, as he was informed that, owing to the growing use of metallic-filament lamps, most of the electric supply companies, whose chief income was derived from lighting revenue, showed a falling off in receipts, while few showed increases. The general expenses were £10,524, against £10,688, a reduction of £164. This saving was mainly due to the better terms they obtained for third-party and workman's compensation insurances, and he expected they would be able to effect a further reduction under this head at the next renewal period, if, as he sincerely hoped, they continued to enjoy the immunity from serious accidents with which they had been blessed for the past four years. The power station expenses were £6,003, against £6,680 in the previous year, a saving of £677, equal to 10 per cent., and at the same time the output of the station had increased from 1,573,074 units to 1,654,452 units, being an addition of 5 per cent. This increased consumption of electric current was accounted for by the greater volume sold to consumers, and to some 1,400 extra miles run by the cars. The works cost per unit of electricity generated was ·97d., and having regard to the character of the lighting load, which was at its maximum in August, when the traction load also reached its highest point, and that the railway carriage and town dues on coal amounted to 12s. 3d. per ton, their electrical engineer and manager, Mr. Forde, deserved every credit for the result. The directors had again waived half their fees, but if the improved condition of the company continued during the current year, they would feel justified in reconsidering the question of their fees. In the report submitted last year, they put before the shareholders the urgent need for an additional installation of electric plant, estimated to cost £7,500, and they had since installed, at a cost of £6,772, the plant and cable extensions they then contemplated. This gave them all the generating power they were likely to want for some time, but the expenditure on cables would have to be added to from time to time in order to extend the business and to get new customers in roads and districts not hitherto supplied, wherever profitable lighting or power business could be secured. Although they had paid away more than £6,000 for this new plant, the amount of their liability on loan account had only increased by £1,000, as they had had the balance in hand from their improved profits. The position of the loan accounts remained practically the same as it did last year, the bankers having renewed the loans on the security of the debentures. It would have been more satisfactory to the directors to have the debentures permanently placed, though they could not procure the money on such favourable interest terms as their bankers charged, owing to the low Bank Rate prevailing for some time past. It would not, however, be in the interest of the shareholders that the debentures should be issued at a sacrifice, and they believed that the value of these securities must before long considerably appreciate. It would be within the recollection of those shareholders who were present at the meeting last year that the directors were subjected to some criticism on the management of the company, and as to its financial position in connection with the loans. A resolution was then passed asking the directors to invite four gentlemen named in the resolution to confer with the board on the general position of the company. The directors in accordance with that resolution lost no time in inviting the gentlemen named to a conference. After this conference they supplied them with every information they desired, and a long correspondence and some further conferences ensued. The result was a series of recommendations, some of which they considered impracticable or of doubtful advantage. Some other recommendations referred to matters which the directors had already considered, and would have been glad to carry out, but they involved the expenditure of money which the directors had not at their disposal. The subject mainly discussed at the shareholders' meeting last year was the question of the indebtedness of the company, and the desirability of placing the loans on a permanent basis at a moderate rate of interest. They accepted the suggestion of the shareholders to call into conference the gentlemen named in the resolution of the meeting, as they knew them to be connected with large financial affairs, and they hoped that they would be able to give them material aid in the financial side of the business. He regretted to say, however, that they got no practical assistance, or offer of assistance, in this direction. The committee pressed very strongly on them one of their recommendations, viz., that the system of electric supply to lighting consumers should be changed from the direct to the alternating current system, with a view to the more extensive use of metallic-filament lamps. Though the directors were satisfied that this was not practicable, owing to the large capital expenditure involved, and that even if it was practicable, it was not desirable, they yielded to the pressure of the Committee, and appointed Mr. Sparks, of the County of London Electric Supply Co., nominated by the Committee themselves, to report on the subject. Mr. Sparks, who was a gentleman of the highest eminence in his profession, had given a report which in every respect confirmed the opinions previously formed and expressed by the directors and their engineer and manager, Mr. Forde, on this subject. He had received a communication from a shareholder suggesting the adoption of ½d. fares. It did not appear that the system had yet been adopted anywhere, and therefore it was impossible to say how it would work out. The directors would give the question their best attention, and consider whether or not it was desirable to introduce the system on their lines.

Mr. H. R. Monks seconded the motion.

Mr. C. Lock, one of the shareholders' committee which conferred with the directors, in a long speech detailed the negotiations which he and his colleagues carried on with the board, and said that they were of opinion that a more energetic policy might be adopted to the advantage of all concerned. He believed the committee had already done some good, the results of which were reflected in the improved accounts. He was sorry that the board had not seen their way to do something in the direction of placing the heavy loans of the company on a permanent basis. The committee were also of opinion that the board might be strengthened by the addition of two experienced business men, one of whom should be a man of local knowledge and influence.

Mr. W. M. Murphy, a director, replying to the criticisms, said he was quite convinced that the directors were carrying on the tramway in as economical and efficient a manner as possible, and they were not in need of any further assistance in that direction. As to the extension of the electric lighting, that had shown a substantial increase last year, and metallic-filament lamps were being used on the system. It would not pay them to transform their system from the direct to the alternating current, as recommended by the committee. As to the debt charges, if the company was let alone and it continued to progress as it had done last year, he believed that in a very short time the debentures would be at such a price that they would be able to place them permanently with the public.

The report was then adopted.

Shanghai Electric Construction Co., Ltd.

The report of the directors, which was presented at the third annual general meeting held at Basildon House, E.C., on Thursday, December 16th, said that a new scale of fares drawn up by the general manager was sanctioned by the Council, and came into operation on February 1st last. As a condition of obtaining the revision of fares, it was found necessary for the company to withdraw its claim for compensation for delay on the part of the Council in supplying power and in opening the bridges for traffic. Apart from the cost of power, the operating expenses of the tramway are low, and compare favourably with those of other systems. The price fixed in the concession agreement for cost of power was based on the estimated cost of production at the time, but the actual cost has been much lower, owing in great part to the company's large demand for power. The Council has consequently been able to reduce the price charged to the public, but the old rate is charged to the company, notwithstanding that it is the largest consumer. In the following statement of the company's traffic receipts since the opening of the tramways, the figures given in the first column show the takings at their nominal value, those in the second column the actual value in Mexican currency, and the difference, shown in the third column, represents loss by exchange:—

	1908. Nominal value. Mex. $.	Amount realised Mex. $.	Loss by exchange Mex. $.	1909. Nominal value. Mex. $.	Amount realised. Mex. $.	Loss by exch'ge. Mex. $.
January..	—	—	—	44,630	37,122	7,508
February	—	—	—	40,726	32,998	7,728
March (27 days in 1908)				42,695	34,440	8,255
April				43,461	34,684	8,777
May	115,512	101,105	14,407	47,900	37,646	10,254
June				41,982	33,889	9,093
July	97,732	91,962	5,770	47,359	35,986	10,373
August	87,829	81,792	6,031	47,8'3	37,419	10,393
September	87,811	81,612	6,199	48,279	37,707	10,572
October	88,357	82,370	5,987	*50,000	*38,500	*11,500
November	89,042	82,847	6,195	*51,000	*40,000	*12,000
December	88,264	82,258	6,006	*Telegraphed.		

About five-sixths of the fares are collected in Chinese copper and small silver coins, on which the loss by exchange, when converted into Mexican dollars, is now about 25 per cent., as against 10 per cent. when the tramways were opened. The balance of the traffic revenue is from season tickets and books of coupons, which are paid for in Mexican dollars. It will be seen that there has been a steady growth of traffic, and that notwithstanding the increasing rate of loss by exchange, the receipts for the nine months, from March to November, show a substantial improvement in 1909 as compared with 1908. The heavy payments to the Council for power, royalty and road maintenance have, however, made serious inroads upon the balance which would otherwise be at the disposal of the company. These matters have been the subject of representations to the Council, and in July last a meeting was held between sub-committees of the Council and of the company's local

board. It was then arranged to convene a special meeting of ratepayers to consider a resolution to be brought forward on behalf of the company, with a view to improving the conditions under which it now works. The matter is in course of active negotiation, but the date of the ratepayers' meeting had not been fixed at the time of the issue of this report. Arrangements have been made with the French Shanghai Tramway Co. for an exchange of traffic by means of through services on certain routes, but this cannot be carried into effect until negotiations between the Councils of the foreign and French settlements with regard to the strengthening or rebuilding of two bridges over the Yang-King-Pang Creek have been concluded. It is believed that the exchange of traffic will be beneficial to both companies. Mr. R. S. Portheim, a director, offered himself for re-election.

At the meeting Sir Alfred Dent, K.C.M.G., presided. In moving the adoption of the above report, he pointed out that there were no accounts to present, as it had been decided in future to make them up to December 31st, which would enable the annual meeting to be held about the end of March. The report gave the approximate receipts month by month from the opening of the tramway service in March, 1908, until November 31st last. They had suffered an enormous loss in exchange, as they had to take fares in depreciated Chinese silver and copper currency, which was practically useless to them, and sold daily at the best price available in exchange for the standard Mexican dollar. They managed to collect season tickets and coupons, which formed a small portion of their income, in Mexican dollars, but the loss in exchange had been steadily increasing during the last two years, until it now stood at over 25 per cent. on the great bulk of their receipts. The Municipal Council recognised that depreciation and sanctioned alterations in the sections and increases on the original fares named in the concession, but the improvement thereby obtained had been largely neutralised by the continued fall in exchange. The operating expenses were at the rate of 20 Mexican cents per car-mile. The statement of traffics was of an encouraging character so far as the gross receipts were concerned, and showed an average increase of more that $10,000 per month from July to November inclusive. While that meant growth of traffic and increasing popularity of the tramway service, it did not represent in the same degree an accession to the company's income, since the loss by exchange had increased almost without a break until the last two or three months, and their effective takings had not increased in proportion to the work they had done in carrying passengers. The expenses were lower now than they were during the first half of the year, and for the four months from July to October they had been earning about $7,000 profit a month in Shanghai, subject to provision for depreciation. It was satisfactory that while they had never had to remit any money to Shanghai they had recently received a remittance of £4,000 from that country, which considerably more than recouped all the expenditure they had made there outside the works contract for stores and other items which formed part of the working expenses. They were asking for an alteration in the concession under the following heads: (1) reduction in the price charged by the Council for power; (2) relief from their present obligation to maintain a portion of the roads traversed by the trams; and (3) a substantial modification of the way in which the royalty was computed. As regarded the arrangements with the French Co., the general manager had gone very fully into the question, and the agreement for mutual running powers was drawn in a way which it was believed would safeguard their interests and secure to them a due advantage in respect of the relatively denser traffics on their system as compared with that of the French Co. The payment to the Council from the start to the end of September for power, royalty and road repair, amounted to £20,500, and over the same period the company had run 2,533,084 car-miles, and carried 14,667,698 passengers. The average number of passengers per week, and the receipts per car-mile were steadily improving, whilst the car-mileage and consumption of power was being reduced, so their position was gathering strength, but they were a long way off any substantial surplus unless the payments to the Council were modified.

Mr. Emile Francqui seconded the motion, and the report was adopted.

S.P. Syndicate, Ltd. (Suchostawer Patents).

At the first ordinary general meeting, held at Winchester House on December 10th, the following report by the directors for the period ending November 15th, 1909, was adopted: "The directors are satisfied that you will consider the report exceedingly encouraging in every way. The syndicate was started on a provisional protection, supported by the assurances of several well-known tramway experts that the patent would be granted, and that it was of practical application and would prove to be the most efficient system of electric traction. The first step was made when a line was built at Southall, one-sixth of a mile long, which would be used for demonstration purposes, and on which practical improvements could be worked out. This line has been in running order for about six months, and works uniformly satisfactorily. The line has been left standing on various occasions for weeks on end in all weathers, and has been used at very short notice, and inspected by some of the most experienced and critical engineers in the country. Even when specially sent to make destructive criticism, if possible, they have been unable to do so. In fact, no expert has ever given an adverse opinion after inspection. In addition, four British patents have been obtained, besides patents in the United States, Canada, Austria-Hungary and India, and protections in other countries. Various municipal authorities have thoroughly investigated the track, and, as the results of the careful tests by those from Dover, as well as by the experts sent by the owners of the Light Railway Order from Dover to St. Margaret's and Martin Mill, the directors have made a provisional contract with these gentlemen. Under this contract the syndicate will construct five-eighths of a mile in Dover, and will electrify the remaining 4½ miles. The railway is very strongly backed, and will certainly be brought to a good paying condition. The first portion of the line will be run in direct connection with the tramways of the Dover Corporation, and will bring sailors from the jetty at which they are landed from the fleet, and the men employed for the East Cliff Works of Sir Weetman Pearson & Co. The directors are negotiating other contracts in Great Britain and in other countries, including Holland, Mexico, France and Russia, which they hope to be able to obtain on advantageous terms. One of the directors, Mr. Drummond, was recently in Canada and the United States on a visit extending from the Atlantic to the Pacific, and during the course of that journey he had the opportunity of discussing the principles involved in the system with leading engineers and users. He was able to favourably impress engineering friends with the advantages and economy of the S.P. system, and obtained reasonable business assurances of support in New York, Chicago, Toronto, Winnipeg, the Western Provinces of British Columbia, and the various engineers at those places are awaiting the development of this company to take advantage of and use the S.P. system as soon as this company is prepared to lay before them not only the detailed plans for the special conditions of each place, but the terms upon which these are to be fulfilled. The shareholders will remember that in view of the very recent date of the present patents the position has yet to be made strong and unassailable in thesecountries; and although there is time in which to ensure the company's safety, yet the directors would urge upon the shareholders the advisability of early action, quite apart from the limit of time at disposal. Mr. Drummond's report to the board is available to any shareholder, and a copy of the same can be seen at the office. These successful results have been achieved by the expenditure of only two-thirds of the working capital of the syndicate, and it is now necessary to make arrangements for the syndicate to construct the Dover line and put itself into a strong financial position. To further this end the directors trust that every shareholder will make a special effort to be present at the meeting."

The capital issued is £5,619.

Stock Exchange Notices.—The Committee have appointed special settling days as under:—

United River Plate Telephone Co. further issue of 30,000 ordinary shares of £5 each, fully and partly (£3) paid, Nos. 120,001 to 150,000 (these are also to be officially quoted); Para Electric Railways and Lighting Co., £700,000 5 per cent. first debenture stock (*ex* all interest paid previous to June 1st, 1909).

Application has been made to the Committee to appoint a special settling day in and to grant a quotation to—

New York Telephone Co., Scrip, fully-paid, for £2,000,000 4½ per cent. first and general mortgage 31-year bonds (London issue).

Prospectuses.—*Kerala Rubber Co., Ltd.*—12,000 shares out of an issue of 33,000 shares of £1 each have been offered to the public this week.

Premier Re-Forming Co., Ltd, Rubber Manufacturers.—This company has lately offered for subscription 100,000 shares of £1 each. It has been formed to acquire the British patent, provisional protection for an improvement, and the secrets in connection with a process of manufacturing within the United Kingdom, rubber articles of every description from waste rubber, indistinguishable from ordinary rubber articles.

Chota Rubber Estates, Ltd.—An issue of 270,000 shares of 2s. each have been offered at par.

The Bradwall (F.M.S.) Rubber Estate, Ltd.—45,000 shares of £1 each have been offered for subscription at par.

Malacca Rubber Plantations, Ltd.—An interim dividend of 10 per cent. is to be paid on January 1st for the year 1909 on the ordinary and preference shares. It is stated that the net profits are estimated at £75,000.

Berlin Telephone Co.—According to a financial daily, a dividend of 11 per cent. is to be paid for the financial year just closed. The report states that orders from home and abroad are abundant.

Continental Notes. — Belgium. — La Compagnie d'Electricité d'Ixelles et Extensions, of Ixelles, Brussels, reports a profit for the last financial year of £3,948.

France.—The balance sheet of the Compagnie Générale d'Electricité, of Paris, for the last financial year shows a net profit of £95,365, as compared with only £90,914 in the preceding 12 months. A dividend of 30 francs per share is being declared.

Switzerland.—The Oerlikon Akkumulatorfabrik Gesellschaft, or Zurich, is increasing its capital from £22,000 to £48,000.

Germany.—A company has just been formed at Ludwigsburg with a capital of £125,000, and the title Die Electricitätswerk Beihingen, Bleidelsheim Gesellschaft, to establish a large central electricity generating station for the supply of current for lighting and power purposes in the town and district of Ludwigsburg. The Felten-Guilleaume-Lahmeyer Co., of Frankfort, is interested in the new undertaking.

MARKET QUOTATIONS.

Wednesday, December 22nd.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	„	28/-	..
a „ Sulphuric	„	5/6	..
a Ammoniac, Sal	„	42/-	..
a Ammonia, Muriate (crystal)	per ton	£23	..
a „ „	„	£30	..
a Bleaching powder	„	£5 10	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£16	..
a Ferro-Silicon (50 %)	„	£10 10	10/- inc.
a Copper Sulphate	„	£18 10	..
a Lead, Nitrate	„	£23 10	£1 inc.
a „ White Sugar	„	£23 10	..
a „ Peroxide	„	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	3½d.	..
a Potassium, Cyanide	„	7d.	..
a Shellac	per cwt.	75/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	„	£6 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70 %)	„	£11	..
a „ Chlorate	per lb.	3½d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
a „ Cyanide (basis 100 %)	„	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£75	..
b „ Wire, in ton lots	„	£112	..
b „ Sheet, in ton lots	„	£120	..
p Babbitt's metal ingots	„	..	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7⅞d.	..
c „ Tube (brazed)	„	9d.	..
c „ „ (solid drawn)	„	7⅞d.	..
c „ Wire, basis	„	6⅝d.	..
c Copper Tubes (brazed)	„	9d.	..
c „ „ (solid drawn	„	9d.	..
g „ Bars (best selected)	per ton	£78	£1 inc.
g „ Sheet	„	£78	£1 inc.
g „ Rod	„	£73	£1 inc.
e „ (Electrolytic) Bars	„	£61	..
e „ „ Sheets	„	£77	..
e „ „ Rod	„	£65 10	..
e „ „ H.C. Wire	per lb.	7¾d.	..
f Ebonite Rod	„	3/3	..
f „ Sheet	„	3/-	..
n German Silver Wire	„	1/6	..
h Gutta-percha, fine	„	5/6 to 6/6	..
h India-rubber, Para fine	„	7/6½	1½d. inc.
i Iron Pig (Cleveland warrants)	per ton	51/6	11½d. inc.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Ingot	„	£18 10	5/- inc.
m Manganin Wire No. 28	per lb.	6/6	..
Mercury	per bot.	£9 14	2/- dec.
d Mica (in original cases) small	per lb.	6d. to 1s.	..
d „ „ „ medium	„	2/6 to 4/-	..
d „ „ „ large	„	4/6 to 8/6	..
p Phosphor Bronze, plain castings	„	..	..
p „ „ rolled bars & rods	„	..	..
p „ „ rolled strip & sheet	„	..	..
o Platinum	per oz.	120/-	variable.
e Silicium Bronze Wire	per lb.	9d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£151 10 to £152	£8 10 inc.
n „ Wire, Nos. 1 to 16	per lb.	1/10	..
p White Anti-friction Metals:— "White Ant" brand	per ton	..	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£27	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
r W. F. Dennis & Co.

Companies to be Struck Off the Register.—The following are to be struck off the register, and accordingly dissolved, unless cause is shown to the contrary within three months:—

Electrical Bleaching Co., Ltd.
Electrical Regulating & Lighting Syndicate, Ltd.
Electrical Supplies, Rubber & Ebonite Co., Ltd.
Electric Lamp Regenerating Co., Ltd.
Electric Railways Co., Ltd.
Electro-Voelker Syndicate, Ltd.
Hillgrove & Armidale Electrical Corporation, Ltd.
McGuire Manufacturing Co., Ltd.
Meyra Electric Co., Ltd.

Canadian General Electric Co.—The directors have declared a dividend of 1¾ per cent. on the common stock for the three months to the 31st inst., being at the rate of 7 per cent. per annum.

Oriental Telephone and Electric Co., Ltd.—The register of transfers of 4 per cent. redeemable debenture stock is closed from December 18th to 31st inst., both days inclusive, for the preparation of warrants for the half-yearly interest due January 1st, 1910.

STOCKS AND SHARES.

Tuesday Afternoon.

Notwithstanding the holiday influences that make for restraint of Stock Exchange business, there is a reasonable, unseasonable amount of activity in various sections round the House, and the electrical departments are by no means left out in the cold. It is recognised that money will become cheaper in the New Year, and, as usual, the Stock Exchange looks forward with gay optimism to a good time coming, after the turn of the twelvemonth. Investment securities are not easy to buy at low prices, and speculation, especially in rubber shares, is tolerably active, although trade will, of course, diminish each day nearer the holidays.

The death of King Leopold lead to a slight feeling of apprehension amongst certain of the Canadian-Mexican descriptions, which are held to a considerable extent in Belgium. It quickly became apparent that the Belgian proprietors were not to be forced into selling by the death of their ruler, and accordingly, the little spasm of weakness passed away without having much effect.

In the Home Railway market there has been a resumption of the better tone, after some dulness at the latter end of last week. Very fitfully the market begins to attract public interest and public purchases. Brighton Deferred stock is strong on the success of the electrified "Elevated" section. Metropolitans have hardened on account of dividend prospects, and the steady progress of the Metropolitan District encourages buying on the part of those who like a gamble in Home Rails. It would appear, however, as though there were some kind of a "tap" running in the case of Districts, and on balance the Ordinary stock shows no change. Underground Electric Railways Income bonds are 2 points higher, and in spite of the rise they have experienced since their speculative attractions were commented upon in this column, as a speculation they still look not too dear.

City and South London Ordinary rose 1. Central London's are each a point higher. London United Tramways Preference at 45s. show a 5s. fall.

Dealers in the Electricity Supply market report their department as "firm," but Westminsters are the only shares in the list to have any advance to their credit. Other London shares are easier where changes have occurred. Charing Cross Preference and the "City Undertaking" shares are lower. Smithfields again receded after their sharp rise. Edmundson's Preference lost their gain of last week, and Newcastle-on-Tyne shares are easier. The new Rosario Electric issue went extremely well, and the price is 15s. premium.

Mexican Light and Power Common stock is 1½ points down, thanks to the Belgian business; Mexico Trams are down ½, and the 5 per cent. bonds are ½ to the good. Rio Trams at 92 are 1 lower. Sao Paulo remains at 153½. The strongest section in the tramway market is that for Anglo-Argentine issues, both classes of Preference shares and the 4 per cent. Debenture stock being again better, on steady buying on behalf of investors. British Columbia Deferred and Preference stocks are each up a point.

The principal movement in the telegraph market has been a fall of 10s. in Great Northern shares, it being stated that the Governments of Great Britain and Norway will take over one of the company's cables in about a year's time. The market is somewhat perplexed as to what the precise effect of this step is likely to be, and motives of prudence rather than those of selling have led to the price being reduced. Anglo-American Telegraph Deferred has see-sawed a little, but on balance the change is no more than ⅛ up. Eastern Telegraph stocks are strong.

American Telephone and Telegraph capital stock fell a point; the company has declared a quarterly dividend of 2 per cent. National Telephones are better. Mackay Companies' Common and Preference stocks have moved in opposite directions. Marconi's are unaltered at 11s. 3d. middle.

Castner-Kellner shares again improved, and Telegraph Constructions regained their decline of a week ago. Rubber shares are the main objects of interest in the Industrial section. The market in these is strong once more, and the recent weakness caused by the result of the last fortnightly sales has disappeared. Holders can now make quite sure that their shares will in no way disturb a Merry Christmas.

Blackpool, St. Annes and Lytham Tramways Co., Ltd.—The annual meeting was held at the beginning of last week at Blackpool. Although at the beginning of September there was a slight decrease on the year's receipts, the increase on the total year's revenue amounted to £2,299, which was largely due to the aviation meeting. Mr. Blare was re-elected a director of the company.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1906.	1908.	1907.	1908.	Closing Quotations Dec. 14th.	Closing Quotations Dec. 21st.	Business done week ended Dec. 21st, 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent.
			1906.	1908.	1907.	1908.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	8⅜ — 8¾	8⅜ — 8⅞	..	..	..	Nil.
136,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	100 —108	100 —108	..	..	..	4 17 1
$121,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½ %	8 %	8 %	8 %	145 —147	144 —146	147	..	—1	5 9 0
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
558,460	Anglo-American Telegraph	Stock	8½%	8⅔%	8½%	£3 4s.	60 — 62	60 — 62	..	..	..	5 8 4
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	100 —101	100 —101	101	100½	..	5 18 0
3,220,770	Do. do. do. Deferred	Stock	1⅞%	1⅞%	1 %	8/-	101½—101½	101½—101½	101½	101½	+ ⅛	1 16 0
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	21⅜ — 21½	21½ — 22	21⅝	21 7/16	+ ⅛	4 17 1
44,000	Chili Telephone, Nos. 1 to 44,000	Stock	8 %	8 %	8 %	8 %	101 —103	101 —103	..	..	..	4 18 6
2,451,350	Commercial Cable, Sting. 500 year 4% Deb. Stk. Red.	10	4 %	4 %	4 %	4 %	7⅞ — 8⅛	7¾ — 8⅛	7 15/16	..	..	4 10 5
16,000	Cuba Telegraph	10	5 %	5 %	5 %	5 %	86½ — 88½	86⅜ — 88¾	87⅛	86½	..	6 9 9
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	8⅜ — 9⅛	8⅜ — 9⅛	..	..	..	5 11 1
6,000	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	17 — 18	17 — 18	..	..	..	5 14 8
12,981	Do. do. 10 % Cum. Pref. ..	10	10 %	10 %	10 %	10 %	3 — 3⅛	3 — 3⅛	..	..	..	6 5 0
6,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	8 — 8½	8 — 8½	..	..	..	4 7 10
80,000	Direct United States Cable	20	4½%	4½%	4½%	4½%	100½—102½	100½—102½	..	..	..	6 4 7
60,710	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	13 — 13½	13 — 13½	..	..	..	4 7 10
43,500	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	100½—102½	100 —102	100½	..	..	6 4 7
4,900,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	132 —135	133 —135	..	..	..	4 7 10
2,000,000	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	84½ — 86½	85 — 87	85½	85	+ ½	4 0 6
1,996,706	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	102 —104	102 —104	102½	102	..	3 16 11
800,000	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	11½ — 12½	11½ — 12½	12⅛	11 1/16	..	5 14 8
752,400	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	102 —104	102 —104	103	..	..	3 16 11
200,000							100 —102	100 —102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5½%	5½%	10½ — 10⅝xd	10½ — 10⅞	10 9/16	10 7/16	..	5 7 0
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13½ — 13⅝	13½ — 14	13 9/16	13¼	..	4 7 8
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	30 — 31	29⅝ — 30½	29⅝	29½	— ⅛	5 18 0
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 8
17,000	Indo-European Telegraph	25	18 %	18 %	18 %	18 %	51 — 53	51 — 53	51⅞	..	—2	7 1 6
$41,380,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	95 — 97 xd	93 — 95	..	..	+2	4 4 3
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	Nil	76 — 78 xd	73 — 80	..	..	..	5 0 0
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	⅛ — ¼	⅛ — ¼	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	2/16 — 3/16	2/16 — 3/16	..	..	..	6 8 0
86,492	Do. do. 5 % Pref.	1	5 %	5 %	5 %	6 %	2/16 — 3/16	2/16 — 3/16	..	..	..	5 6 8
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	106½ -108	106½ —108	107⅜	107	..	5 11 1
3,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	122 —124	123 —125	123¼	123⅛	+1	4 16 0
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10½ — 11	10½ — 11	..	..	..	5 9 1
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10¾ — 10⅞	10¾ — 10⅞	..	..	..	5 10 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜ — 5⅝	5 7/16 — 5 9/16	5 7/16	5 7/16	+ 1/16	4 8 7
2,000,000	Do. do. 8½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	3½%	98 —100	98½ —100½	99	..	+ ½	3 9 8
1,988,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100½ —102½	102½	..	+ ½	3 18 1
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1⅜ — 1½	1⅜ — 1½	..	..	..	5 5 9
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 7/16 — 1 9/16	1 7/16 — 1 9/16	..	..	..	4 14 9
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	87⅛ — 88⅜	87⅛ — 89⅛	..	..	+ ⅛	4 9 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	8	5 %	5 %	5 %	5 %	100 —102	100 —102	..	..	..	3 18 5
11,889	Reuter's	100	4½%	4½%	4½%	4½%	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	Cert.	6 %	6 %	6 %	6 %	101 —103	101 —103	..	..	..	4 7 10
3,042	Submarine Cables Trust	5	8 %	8 %	8 %	8 %	129 —132	129 —132	..	..	..	4 7 5
120,000	United River Plate Telephone	5	5 %	5 %	5 %	5 %	7 — 7¼	7 — 7⅛	7 1/16	7	..	5 10 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	2½	Nil	Nil	2½%	2½%	5⅛ — 5⅝	5⅛ — 5⅝	..	..	..	4 6 11
80,008	W. Coast of America, 1 to 80,000 & 53,001 to 53,008	100	4 %	4 %	4 %	4 %	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..	3 16 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Brzz. Sub. Tel.	10	7 %	7 %	7 %	7 %	100 —102	100 —102	..	..	..	3 18 5
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	100	4 %	4 %	4 %	4 %	13⅜ — 14	13½ — 14	13 5/8	13½	..	5 0 0
800,000	Do. do. 4 % Deb. Stock Red. ..	10	Nil	Nil	Nil	Nil	103 —105	103 —105	104½	..	..	3 16 2
88,321	West India and Panama Telegraph	10	5 %	Nil	8 %	6 %	⅜ — ⅝	⅜ — ⅝	..	..	..	Nil
84,568	Do. do. 6 % Cum. 1st Pref.	10	Nil	Nil	Nil	£2 6	8⅞ — 9⅛	8⅞ — 9⅛	..	..	..	6 9 9
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	15 %	8 — 9	8 — 9	..	..	..	6 13 4
80,000	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	102 —104	102 —104	..	..	..	4 16 2

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	5	..	..	..	..	4⅛ — 4⅜	4⅛ — 4⅜	95/-	93/1½	+ ⅛	5 2 7
500,000	Do. 5 % 2nd Pref., 800,001 to 1,300,000	5	..	..	..	..	4⅛ — 4⅜	4⅛ — 4⅝	90/7½	88/9	+ ⅛	5 8 1
978,280	Do. 4 % Deb. Stock	Stock	..	..	..	4 %	91½—93	92 — 93½	93½	92½	+ ½	4 5 7
883,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	104 —107	104 —107	..	..	..	4 13 6
880,000	Babcock & Wilcox, 1 to 880,000..	1	20 %	20 %	20 %	20 %	4⅜ — 4⅝	4⅜ — 4⅝	93/9	92/6	..	4 3 9
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	5	6 %	6 %	6 %	6 %	1 7/16 — 1 9/16	1 7/16 — 1 9/16	..	..	..	8 19 2
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	Nil	1 — 1⅛	1 — 1⅛	..	..	..	Nil
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..	7 15 0
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3⅛ — 3⅜	3⅛ — 3⅜	..	..	..	7 10 11
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	2 %	2⅜ — 3⅛	2⅜ — 3⅛	..	..	..	5 11 1
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	96 — 99	97 —100	..	..	+1	5 10 0
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	138 —142 xd	139 —143	141½	141	+1	5 11 4
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	121 —125	121 —125	122½	..	..	4 16 9
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	107 —110	108 —111	110½	..	+1	4 10 1
288,000	Do. 4½ % 1st Mort. Debs., 1 to 6,950	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 6 2
188,801	British Electric Traction	10	8 %	Nil	Nil	Nil	⅜ — 1	⅜ — 1	..	..	..	Nil
161,487	Do. do. 6 % Cum. Pref.	10	6 %	6 %	8 %	1½%	2⅜ — 3	2½ — 3	55/7½	..	..	5 0 0
1,473,653	Do. do. 5 % Perp. Deb. Stock	Stock	5 %	5 %	5 %	5 %	84 — 87	84 — 87	..	..	..	6 14 11
598,986	Do. do. 4½ % 2nd Deb. Stock Red. ..	100	4½%	4½%	4½%	4½%	60 — 65	60 — 65	62	61½	..	7 10 0
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7 — 7½	7 — 7½	..	..	..	6 13 4
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6½ — 6⅝	6½ — 6⅝	6 5/8	..	..	4 10 7
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
204,940	British Thomson-Houston 4½ % 1st Mort. Debs.	100	4½%	4½%	4½%	4½%	89 — 94	89 — 94	..	..	..	4 15 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 75,000	5	Nil	Nil	Nil	Nil	⅜ — ⅝	⅜ — ⅝	..	..	..	Nil
1,916,868	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	48 — 52	48 — 52	50½	50¼	..	7 13 10
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	1/16 — 3/16	1/16 — 3/16	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	41 — 46	41 — 46	..	..	..	9 15 8
125,000	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 — 31	27 — 31	..	..	..	14 10 2
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	6 %	4½%	4⅜ — 5	4⅜ — 5	..	..	..	4 10 0
45,804	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	5 %	5 %	5 %	5 %	4⅜ — 5	4⅜ — 5	..	..	..	5 0 0
850,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	101 —104	101 —104	97/6	95/7½	..	4 6 7
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	15 %	10 — 10⅜	10 — 10⅜	102½	..	..	6 19 4
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 8 11
800,000	Do. do. 4½ % 1st Mort. Deb. Red.	Stock	4½%	4½%	4½%	4½%	105 —107	105 —107	..	..	..	4 4 1
491,229	Cape E. Trams., 1 to 491,229	1	Nil	Nil	Nil	Nil	2/16 — 3/16	2/16 — 3/16	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	12½%	2⅛ — 2⅜	2 1/16 — 2 3/16	49/-	46/-	+ 1/16	5 2 0
910,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	105 —107	105 —107	..	..	..	3 14 1
1,980,690	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	4 %	62 — 64	63 — 65	..	..	+1	5 0 0
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	3 %	3½%	84 — 86	85 — 87	86	85⅜	+1	4 12 0
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	44 — 46	45 — 47	..	..	+1	5 6 5
1,980,000	City and South London Railway	Stock	13⅓%	2½%	2½%	Nil	31 —	32 — 33	32½	31½	+1	4 10 0
85,000	Crompton & Co., Nos. 1 to 85,000	8	2½%	5 %	5 %		½ —	½ — 1	..	..	..	Nil
100,000	Do. 5 % 1st Mort. Reg. Debs., 1 to one of £125, and 921 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	90 —	90 — 93	..	..	..	5 7 6

* Unless otherwise stated, all shares are fully paid.

‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued.*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1905.	1906.	1907.	1908.	Closing Quotations Dec. 14th.	Closing Quotations Dec. 21st.	Business done week ended Dec. 21st, 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	* 1	10 %	10 %	10 %	6 %	1 — 1⅛	1 — 1⅛	..	..	..	6 9 0
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000 ..	1	6 %	6 %	6 %	6 %	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..	5 4 4
271,680	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	13⅜ — 13⅝	13⅜ — 13⅝	..	..	..	4 7 3
99,961	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,961	5	4½%	4½%	2½%	Nil	3/32 — 3/32	3/32 — 3/32	..	..	..	Nil
17,189	Do. "A" shares, 01—017,189 ..	5	4½%	4½%	2½%	Nil	1 — 1⅛	1 — 1⅛	..	..	..	Nil
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	66 — 71	66 — 71	..	..	..	5 12 1
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	81 — 84	81 — 84	..	..	..	5 19 1
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
81,890	Do. do. 7 % Cum. Pref., 1 to 81,890.	2	7 %	7 %	7 %	7 %	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	10 4 0
95,000	General Electric Co. (1900), 5 % Cum. Pref. ..	10	5 %	5 %	5 %	5 %	8 — 8½	8 — 8½	..	..	..	5 17 8
210,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	83 — 87	83 — 87	..	..	..	4 12 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	¾ %	Nil	3/8 — 7/8	3/8 — 7/8	..	..	..	Nil
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10½ — 10⅝	10½ — 10⅝	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103½	102 —103	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	12 — 12⅜	12 — 12⅝	..	..	..	5 17 8
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 — 5⅛	5 — 5⅛	..	..	..	4 3 9
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	104 —106	104 —106	..	..	..	4 4 11
50,000	India-Rubber, Gutta-percha & Telegraph Works..	10	10%	10 %	10 %	10 %	15⅞ — 16⅛	15⅞ — 16⅛	16⅛	..	..	6 1 3
37,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	⅛ %	Nil	3/32 — 1/8	3/32 — 1/8	..	..	..	Nil
10,000	† Do. do. Pref., fully paid ..	10	5 %	5 %	5 %	5 %	4½ — 5	4½ — 5	..	..	..	10 0 0
600,070	London United Trams. (1901), 1 to 60,007	10	3 %	3 %	3 %	Nil	1⅛ — 2⅛	1⅛ — 2⅛	..	..	..	Nil
899,980	Do. do. 60,008 to 100,000	10	3 %	3 %	3 %	Nil	1⅛ — 2⅛	1⅛ — 2⅛	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3⅔%	2⅛ — 2⅜	2 — 2⅛	41/8	..	— ⅛	15 0 0
1,649,980	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	62 — 65	61 — 64	..	..	— 1	6 5 0
b,782,062	Metropolitan Consolidated	100	2⅜%	1 %	⅛%	⅛%	38⅛ — 39	39⅛ — 40	39⅞	39	+ ⅜	1 5 0
2,640,214	Do. Surplus Lands	100	2⅜%	2⅜%	2⅜%	2⅜%	66 — 68	66 — 68	67⅛	66½	..	4 0 11
3,285,000	Do. District	100	Nil	Nil	Nil	Nil	17⅜ — 18⅛	17⅜ — 18⅛	18	17⅜	..	Nil
891,387	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	⅛ — ¼	⅛ — ¼	..	..	..	6 10 11
814,016	Do. do. Defd...	1	Nil	Nil	Nil	Nil	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref. ..	1	5 %	5 %	5 %	5 %	7/16 — 9/16	7/16 — 9/16	..	..	..	6 3 1
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 13 9
$10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	123¾ —125⅛	123 —125	125	123⅜	— ⅛	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	91 — 93	91½ — 93½	92⅜	91⅛	+ ½	5 6 11
265,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	3/8 — 7/16	3/8 — 7/16	..	..	..	..
265,500	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	9/16 — 11/16	9/16 — 11/16	..	..	..	6 17 11
245,000	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	84 — 87	84 — 87	..	..	..	5 3 6
37,850	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	34 — 35½	34½ — 36	35½	34½	+ ½	5 3 0
140,000£	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 18 1
1,000,000	Underground Electric Railway, 5% Prior Lien ..	..	..	..	..	5 %	100¼ —101¼	100¼ —101¼	101⅛	100⅝	..	4 18 6
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	87 — 89	88 — 89	90	88½	+ ½	5 1 2
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	32 — 34	34 — 36	..	..	+ ½	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	1	Nil	Nil	10 %	5 %	1/16 — 1/8	1/16 — 1/8	9/9	..	..	..
66,666	Do. 6 % C.P., 80,001 to 80,000 & 125,001 to 141,666	5	Nil	..	6 %	6 %	1⅜ — 2⅛	1⅜ — 2⅛	..	..	..	2 8 4
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	72 — 77	72 — 77	..	..	..	5 1 3

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000	5	5⅓%	5⅓%	5⅓%	5⅓%	4½ — 4	4½ — 4⅝	..	..	..	5 15 9
70,000	Do. do. 4½ % 1st. deb. stock ..	100	4½%	4½%	4½%	4½%	91 — 94	91 — 94	..	..	..	4 13 9
30,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	7 — 7⅛	— 7⅛	..	..	..	6 18 4
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7 — 7⅛	7 — 7⅛	..	..	..	4 13 4
400,000	Central Electric Supply 4 % Guar. Deb. Stock ..	£20	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply ..	5	5 %	5 %	5 %	5 %	3⅜ — 4⅛	3⅜ — 4⅛	83/9	78/1½	..	5 17 8
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅛ — 4⅜	4⅛ — 4⅜	..	..	— ⅛	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅞ — 4⅛	3⅞ — 4	75/-	..	— ½	5 0 0
445,736	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	98 —101	98 —101	..	..	..	3 19 8
49,436	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3⅞ — 3⅝	3⅝ — 3⅝	68/9	66/3	..	6 4 2
175,000£	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10⅛ — 10⅜	10⅛ — 10⅜	..	..	..	5 11 2
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11⅜ — 12⅛	11⅜ — 12⅛	..	..	..	4 12 4
400,000£	Do. 5 % Db. Stk.	Stock	5 %	5 %	5 %	5 %	121 —124	121 —124	..	..	..	4 0 8
300,000	Do. 4½ % 2nd. Db. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	1⅞ — 2	1⅞ — 2	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref. ..	5	5 %	5 %	5 %	5 %	2⅝ — 3⅛	2⅝ — 3⅛	..	..	..	7 8 2
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93⅜ — 95⅝	93⅜ — 95⅝	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅝ — 8	7⅝ — 8	..	..	..	6 5 0
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝ — 11⅛	10⅝ — 11⅛	10½	..	..	5 7 10
400,000£	Do. do. 4½ % Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	105 —108	105 —108	107⅛	107⅛	..	4 3 4
400,000	Do. do. 4½ % 2nd. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	98 —101	98 —101	100⅜	100	..	4 9 1
80,000	Edmundson's Electric Corporation, Ord. Shares ..	5	4 %	Nil	Nil	Nil	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	3 %	Nil	Nil	3/16 — 5/16	3/16 — 5/16	..	..	— ⅛	Nil
480,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	57 — 60	57 — 60	58	..	..	7 10 0
$1,150,000	Electrical Dev.Co.of Ontario, 5% 1stMtg.Gold Bnds.	$500	..	..	..	5 %	91 — 94	91 — 94	..	..	..	5 6 5
10,000	Folkestone, 1 to 10,000	5	5⅓%	5⅓%	5⅓%	5⅓%	4⅜ — 4⅞	4⅜ — 4⅞	..	..	..	5 12 10
10,000	Do. 5 % Cum. Pref., 1 to 10,000 ..	5	5 %	5 %	5 %	5 %	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	4 13 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	6⅞ — 7⅛	6⅞ — 7⅛	7⅛	..	..	5 13 4
$1,876,000	Kaministiquia Power Co., 5 % Gold Bnds. ..	100	..	..	..	5 %	101 —103	101⅛ —103½	102⅛	..	+ ⅛	4 16 7
21,000	Kensington and Knightsbridge Electric Ord. ..	5	10 %	10 %	10 %	8 %	7 — 7⅛	7 — 7⅛	..	..	..	5 4 1
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
111,000	London Electric Supply Corporation, Limited, Ord.	5	4 %	4 %	2½%	3 %	1⅝ — 2	1⅝ — 2	..	..	..	4 8 11
70,000	Do. do. do 6 % Pref. ..	5	6 %	6 %	6 %	6 %	4⅛ — 5⅛	4⅛ — 5⅛	..	..	..	5 17 1
882,855	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	92 — 95	92 — 95	94	93	..	4 4 8
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	3⅞ — 4⅛	3⅞ — 4⅛	85/-	..	..	5 14 3
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅛ — 5	4⅛ — 5	85/-	..	..	4 10 0
235,000	Do. 4½ % 1st Mort. Deben. Stock ..	Stock	4½%	4½%	4½%	4½%	106 —109	106 —109	..	..	..	4 2 7
348,000£	Do. 3½ % Mort. Deben. Stock Redem.	stock	3½%	3½%	3½%	3½%	83½ — 86½	83½ — 86½	..	..	..	4 0 11
$1,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	100	5 %	5 %	5 %	5 %	81 — 83	81 — 83	82½	..	..	6 0 6
£8,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	3½%	69¼ — 71⅛	68 — 70	69⅜	67½	+ 1½	5 0 0
$1,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	101 —105	101 —105	..	..	..	6 13 4
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	100	..	..	..	5 %	85 — 87	85 — 87	86½	85⅝	..	5 14 11
950,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	98 —100	98 —100	..	..	..	4 10 0
130,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	8 %	8 %	2½%	4 — 4⅛	3⅞ — 4⅛	..	..	— ⅛	2 16 9
137,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	4 — 4⅛	3⅞ — 4⅛	..	..	— ⅛	5 17 8
126,500	{North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265}	100	..	..	..	..	98 — 100	98 —100	..	..	..	..
10,853	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	12½ — 13⅛	12½ — 13⅛	12⅛	..	..	5 6 0
20,000	Oxford, 1 to 96 and 407 to 20,810	5	7 %	7 %	7 %	..	6 — 6⅛	6 — 6⅛	..	..	..	5 7 8
80,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,894	River Plate Electy. Co. Ord. Nos. 1 to 120,507 ..	1	..	2½%	6 %	8 %	1⅛ — 1⅜	1⅛ — 1⅜	31/6	30/3	..	4 18 6
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	1 3/32 — 1 5/32	1 3/32 — 1 5/32	..	..	..	5 19 0
200,000	Do. do. 6% Deb. Stk. Red.	100	6 %	6 %	6 %	6 %	103 —106	103 —106	..	..	..	4 14 4
40,000	St. James' and Pall Mall Electric Light, Ord. ..	5	12½%	10 %	10 %	10 %	8¾ — 9	8¾ — 9	..	..	..	6 7 0
80,000	Do. do. 7 % Pref. 20,001 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7⅛	7 — 7⅛	..	..	..	5 11 1
162,000£	Do. do. 3½ % Deb. Stock Red. ..	100	3 %	3½%	3½%	3½%	84 — 88	84 — 88	85½	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	1⅞ — 2⅛	1⅞ — 2	35/7½	35/-	— ⅛	Nil
65,000	South London Electric Supply, Ord.	4	4 %	3 %	4 %	5 %	2⅝ — 3	2⅝ — 3	..	..	..	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	1/16 — 1/8	1/16 — 1/8	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 1/16 — 1 1/8	1 1/16 — 1 1/8	..	..	..	5 17 11
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	3/16 — 7/16	3/16 — 7/16	..	..	..	25 6 8
80,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	14 5 4
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	74½ — 78½	74½ — 78½	..	..	..	5 14 8
208,000	Victoria Falls Power Co., Pref. Nos. 1 to 208,000 ..	1	..	..	..	5 %	3/8 — 7/16	3/8 — 7/16	..	..	..	5 6 8
100,000	Westminster Electric Supply, Ord.	5	18 %	12 %	10 %	10 %	8½ — 9	8½ — 9	8 15/16	..	..	5 12 8
21,478	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	5 — 5⅛	5⅛ — 5⅜	5 1/16	..	+ ⅛	4 0 0

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

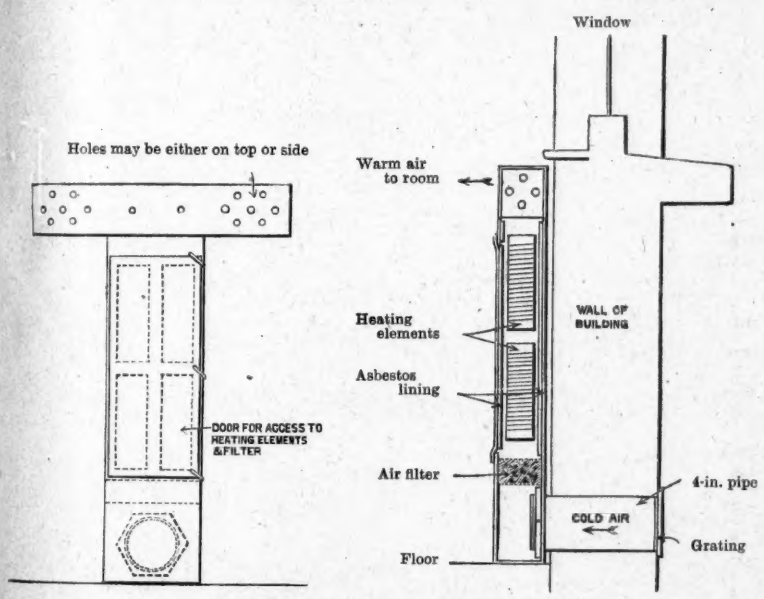
Bank rate of Discount 4½ per cent., December 9th, 1909.

ELECTRIC HEATING AND VENTILATION.

A simple method of heating air for the ventilation of buildings is being tried by the Westminster Electric Supply Corporation, Ltd. As shown in the accompanying illustrations, a combination of the Tobin tube and a convector is employed, with or without an air filter. Any electrical heating element may be used, and the apparatus may be made of any material and any shape. It is intended as a permanent fitting, and should preferably be fixed under the windows. The air enters from the outside, and passes through a filter, then through the heating chamber, into the top, and out through holes. The front is either fitted with a door, so that the heating elements may be got at for repairs, or can be arranged so as to allow them to be taken out through the top. The heating chamber is lined with some non-conducting material, such as asbestos, to prevent the outside of the chamber getting hot.

Apparatus such as this can be made by anyone, and being inexpensive, it should appeal to housholders, architects and builders. In calculating the size of heater required for any room, the company suggests that 1 watt per cubic foot be allowed. This would generally give more heat than required if left on, but would be useful for warming up the room quickly. When the room was sufficiently warm, one-third or two-thirds of the heat would be enough to maintain the temperature. This apparatus should be especially suitable for London houses, where there is always a difficulty in opening the windows for ventilation on account of the noise and dirt.

In the pattern to be fitted by the company, there will be three heats, as in most convectors, but this is a matter of detail. Other matters, which can be suited to individual tastes, are the methods of getting at the heating elements and filter, the shape of the top and arrangement of outlet holes, while some may wish to add a damper, others a baffle plate. The main object is to provide a system which is economical both to install and to use, and it is hoped this has been achieved. We are indebted for these particulars to Mr. L. H. Hordern, the manager.



Electric Heating and Ventilation.

Electric Crane for Lourenço Marques.—We understand that the firms who tendered for the contract to supply an electric crane to the Port of Lourenço Marques were:—Dick, Kerr and Co., of London; Cowans, Sheldon & Co., of Carlisle; Ransomes and Rapier, of London; Fried. Krupp, of Magdeburg; and Nagel and Kaemp, of Hamburg. Owing to the manner in which the tenders were drawn up, they could not be compared, and the Director of Port and Railways is giving them a careful study before awarding the contract.—*Commercial Intelligence.*

The Arc Works Benefit Society.—The annual meeting of the Arc Works Voluntary Sick Benefit Society was held recently, at which it was shown that the total receipts were £390, and the total expenses £316, leaving £74 for distribution, and a reserve of £101 in the bank. Mr. A. J. Hodgson presided, supported by Mr. Claud Crompton. Messrs. Crompton & Co., Ltd., generously supported the fund. Mr. W. G. Bickmore is secretary of the society.

PROCEEDINGS OF INSTITUTIONS.

Notes on Methods and Practice in the German Electrical Industry.

By L. J. Lepine and A. R. Stelling, Dipl.Ing., Students.

(*Abstract of paper read before the* Institution of Electrical Engineers, *London, December 9th*, 1909.)

(*Concluded from page* 999.)

Works and their Systems (Methods in Manufacture).

One is struck when passing through the works of all the four large firms already mentioned by the order and cleanliness which there obtains, though the ventilation leaves much to be desired.

The machinery is most advantageously distributed with regard to light, transport, and the rotation of machinery operations. For instance, in the new shop for building 20,000-kw. sets the scheme is to move stator and rotor along ground and first floor respectively, entering the shop at one end in the rough, and leaving at the other end after testing.

The large machine-erecting shops are also made to serve for advertising purposes in a very effective way. On each large stator or magnet yoke is stencilled its destination and output, so that the visitor or prospective customer is duly impressed in favour of the particular firm as he walks through their shops and finds that his friends or competitors have already placed their orders.

Where narrow and long buildings of four and five storeys are in use, lighting shafts are arranged every 30 ft. or so. The very stringent factory inspection and regulations are responsible for the excellent protective devices on machine tools, these guards being more thorough and efficient than those in the average English works.

Group driving of machines seems to be preferred by most firms, but one of the largest has nothing but independent motor drives.

Each department has its own stores, and the departments are so arranged that a minimum amount of transport is necessary to pass each unit from one stage of manufacture to the next.

The capital at their disposal has enabled these firms to lay down large numbers of special machines, thereby reducing the time taken in machining and the wages of the machinists. German designers work with a view of adapting their designs to suit their machine tools.

Automatic machinery is largely used, as are also turret lathes, but jig-work does not receive the attention given to it by up-to-date English firms. Large machining plates for portable tools are in evidence. The majority of the machine tools are of American manufacture.

The most striking feature in the works system is the working day. This consists of 18 hours, worked in two shifts of 9 hours each, with ½-hour intervals in the middle of each shift and half an hour between the two. Thus the shifts are from 7 a.m. to 4.15 p.m., and from 4.45 p.m. to 2 a.m. This system has many great advantages; quick delivery is possible without the necessity of high wages and establishment charges due to overtime and "night shifts," because the rates of pay in the two shifts vary but slightly. Overtime is an unknown quantity, the output per machine tool is doubled, capital charges are consequently reduced, and a larger number of men can be kept in constant employment. We regard this 18-hour day as one of the most important factors of Germany's competitive powers.

The system presents very few technical difficulties in management; the connection between the shifts can be maintained by means of detailed reports and co-operation between the foremen and charge hands of the respective shifts.

The labour problem in Germany does not present the difficulties that it does in this country, two factors being mainly responsible for this.

The first is the political nature of most of the Trade Unions, these Unions not having arisen as a result of evil conditions in the trades, as was the case in England. When German industries were established, the examples they had from the previous 30 years in England enabled the Government to commence a series of legislative measures for the protection of the workman; in this way he was assured the many benefits for which his English brother had had to go through troublous times.

The other factor is the thoughtful legislation on the part of the German Government; the labour question has been tackled in a most scientific way, and measures of great value to the workmen have been made law as a result of thoughtful consideration of the problems arising, without the misery of strikes on the part of the workmen. Strikes there are still, but statistics prove their decrease year by year.

Another important feature in the cheap production is the low rate of wages paid. We have already mentioned the large amount of unskilled labour employed, but even the skilled labourer is paid at an extremely low rate. Thus we find that the average wage for mechanics is 32s, and winders on high-tension stators earn all in all 36s. a week as a maximum. Male winders of small induction motor stators and rotors earn anything up to 30s. a week. Female labour is employed very largely, all the taping of induction motor stators being done by females, as well as the actual winding of small rotors and direct-current armatures. Small coil forming and magnet windings are of course done by girls. We observed girls working turrent lathes, tending automatic machines, testing arc lamps and instruments, and doing many other kinds of work usually done by men in England. We are bound to state that females *can* earn higher wages than those employed in English works, and they possess especial privileges under a very thoughtful legislation.

Piecework is the rule, with the "Kollonnen system" in erecting. This system, under which one man is given finished units, a number of assistants and a fixed sum for the erection, out of which all wages are to be paid, is in vogue in England in the machine-tool trade.

As regards individual workmanship, the German electrical engineering firms do not compare favourably with the English; "deep scratch and high polish," careless and untidy taping and stringing of coils and a lack of finish are too often noticeable in the work of many first-class firms.

GENERAL FEATURES AND DESIGN OF MACHINERY.

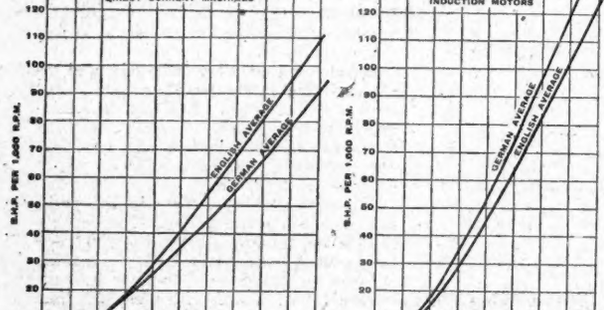
Almost all German firms insist upon the acceptance of their own specifications, and will rarely if ever depart from these. Under this system makers stand or fall by their own designs and productions; they do not suffer the annoyance of petty alterations, and the experience of their experts in each branch enables them to supply an adequate article without having to submit to outside individual ideas. However strict a specification may be, bad workmanship will destroy its object.

Direct current Machines.—The designers differentiate between slow, high and extra-high speed machines, the latter being classed as "turbo-machinery." The line of demarcation between slow and high speeds is 20 m./sec. peripheral speed.

Slow-speed machines are designed with a moderate ratio of iron to copper, and are often fitted with laminated poles. High-speed have a larger ratio of iron to copper, and are often fitted with solid poles, either cast in or cut from a steel billet.

For smaller sizes of motors up to 40 and 50 B.H.P., cast-iron yokes seem popular. On larger sizes cast-in poles find very little favour, the most popular form being laminated poles in a steel yoke.

The practice in winding field coils differs somewhat from the English. Large field coils are wound in three or four layers, with ventilating spaces between the layers. Bare strip for interpole



FIGS. 1 AND 2.—COMPARISON OF WEIGHTS.

winding has not yet been even experimented with, though varnished wire has become practically universal for small-size interpole coils. Brass bridges between the main pole-tips are used wherever interpoles are fitted.

Slot insulation varies considerably, but presspahn and micanite on cloth seem to be the most extensively used materials.

Core plates are still insulated by means of thin layers of paper pressed on to the plates. The plates are held together in almost every case by bolts, insulated where they pass through the laminations.

Taken all round, the English direct-current machine shows more modern principles of design, and except for slow-speed haulage motors, with which the Germans are very successful, England is in no way behind as regards design and workmanship.

Fig. 1 shows a set of curves plotted for the purpose of comparison of English and German direct-current motors up to 100 B.H.P., with the horse-power per 1 000 R.P.M. plotted against the weights. The motors were all taken on a 440-volt rating. It will be seen that the average German machines appear to be heavier than the English above 30 B.H.P., but under 30 B.H.P. there is not much difference.

With regard to machines above 100 B.H.P. it was rather difficult to make a comparison, owing to the fact that German makers favour slow-speed machinery, while the tendency in England is towards high speed. This variance is the result of the different engine-makers' standards in the respective countries. The German high-speed machines are built chiefly for belt driving.

Regarding the electrical design, German firms used to design their machines with very large diameters and short length of core. This practice led to a large ratio of iron to copper in the armatures, the ratio of 2·7 to 1 often being reached. New designs have been brought out in which the weights of active iron have been reduced, and the ratios of 1·8 to 1 and 2 to 1 are now more prevalent. The saturation of the teeth is carried high, 24,000 lines per sq. cm. being a good average maximum density.

The following figures, based upon averages taken from about 30 machines by various makers, may be of interest in comparison with English practice:—

	German Machines Design Data.			English Machines Design Data.		
Output, KW.	0·10	50	150	4·65	50	150
Output, KW./1,000 R.P.M.	4·5	70	300	4·5	65	300
Amp.-conductors per cm.-periphery	90-110	150-250	200-280	130	180	280
Current density amps./sq. mm.	2·7	2·75	2·8	4·3	3·4	3·1
Air-gap induction lines/sq. cm.	7,000	7,500	8,000	6,700	6,850	7,350
$\frac{D^2ln \times 10^{-4}}{\text{KW. at 1,000 R.P.M.}}$ in cm. units.	100	50-60	40	88	58	49
$\frac{\text{Armature iron kg.}}{\text{KW. per 1,000 R.P.M.}}$	4·0	2·0	1·5 slow 1·75 high	3·0	1·6-2·2	1·3
$\frac{\text{Armature copper kg.}}{\text{KW. per 1,000 R.P.M.}}$	2·1	1·1	0·75	1·6	0·7-0·75	0·62
Ratio $\frac{\text{armature iron}}{\text{armature copper}}$	1·9	1·8	2·0 slow 2·3 high	1·9	2·3-2·9	2·5
Ratio $\frac{\text{total active iron}}{\text{total active copper}}$						
High speed	1·5	1·5-2·0	2·0-3·0	1·3	1·8	1·6
Slow speed	1·0	1·5-1·8	1·8-2·5			

Note.—Active iron includes poles, pole-shoes, and armature core but not the magnet yoke. This is done on account of the use of cast-iron yokes by German firms.

Induction Motors.—The tendency in the design of this class of motor appears to be towards long length of core and smaller diameter, possibly on account of their frequent use in driving high-speed centrifugal pumps, &c.; forced ventilation is becoming more popular. German engineers have been the first to recognise that vent ducts through the cores parallel to the axis are more efficient than radial ducts, and have begun to adopt this principle.

The motors are very liberally designed with regard to iron, and most designers give a larger ratio of iron to copper than is English practice. This applies to inactive as well as active iron; there are large spaces between stator core and stator case, and there seems plenty of room for the end windings inside the end plates.

The stator windings of small motors are usually of the threaded-through type in closed insulating troughs, semi-enclosed slots being invariably used. Steel rods are used to fill out the troughs when winding. All the taping is female labour, and is very often slovenly. It comes as a shock to an English engineer to see the primitive formers and methods in winding in vogue in German works.

Large rotors are often wound with closed circuits as distinct from "squirrel-cage," and rotors are designed with one bar per slot connected in 3, 5, 7, or 11 phases, according to size. Slip-rings are almost always gun-metal, held on insulated rods, with copper gauze brushes as a general rule. They are arranged between rotor and bearing as standard practice, and are usually fitted with a short-circuiting and brush-lifting device.

The terminals appear to have been very carefully designed, and are arranged on the stator core in a hole cored out of the stator case; this is covered as a standard practice with perforated zinc, and the whole presents a very neat finish.

Altogether we are more favourably impressed by German induction motors than by direct-current motors, though English designs are in no way behind those of Germany.

In fig. 2 we give a curve of weights against outputs of German and English induction motors.

Below some design data are given of German motors; the figures are taken from standard machines of latest design. For the purpose of comparison we give a table of data taken from up-to-date English motors, which are lighter than the average:—

	German Design Data.			English Design Data.		
Output, H.P.	25	52	150	25	60	150
Output, H.P. at 1,000 R.P.M.	25	80	200	25	80	200
Amp.-conductors per cm.-periphery	217	220	200	225	245	275
Air-gap induction, lines/sq. cm.	5,400	5,600	5,770	4,400	4,700	4,850
Core-length	0·96	1·18	0·98	0·84	0·94	0·94
$\frac{\text{Pole-pitch}}{D^2l\,n\,10^{-4}}$ in cm. units	65·5	53·5	53·0	100	70	60
$\frac{\text{H.P. per 1,000 R.P.M.}}{\text{Kg. iron}}$	8	4·5	3·3	7	3·5	2·55
$\frac{\text{H.P. at 1,000 R.P.M.}}{\text{Kg. copper}}$	2·4	1·36	1·15	2·4	1·5	1·1
Ratio $\frac{\text{H.P. at 1,000 R.P.M.}}{\text{active iron}}$ / $\frac{\text{H.P. at 1,000 R.P.M.}}{\text{active copper}}$	3·3	3·3	2·85	2·95	2·35	

Alternating-Current Generators.—Owing to the frequent use of long-distance transmission and "overland" central stations, there is a larger demand for high-tension alternators than in England, and manufacturers have consequently gained large experience in the design of this class of machine. Here again are noticed the long cores and small diameters, and the axial ventilating ducts. The air-space between stator core and case is very large.

In the design of rotating fields many variations are noticeable. For high-speed alternators the hub is built up of forged slabs 3 in. thick, into which the poles are dovetailed. In some cases the poles

and hub are built up of slabs, pole-shoes being dovetailed on, and the windings held in place by special rings and wedges. In one interesting case, that of an 8-pole alternator 8 or 9 ft. in diameter, the whole magnet, yoke, poles, and pole-shoes are formed of slabs cut from solid forgings to the required shape. Grooves 2¼ in. wide are milled along the pole-faces, that is to say, one groove in each slab. In this groove laminations are placed whose outer radius is eccentric to the stator bore.

The field windings are made as follows:—Copper strip is wound on edge on a mandrel so designed that the turns are too long in the axis parallel to the shaft. The turns are cut forming two U-shaped pieces, and are then placed on the pole (which has been packed with insulation to the exact shape required), alternately with sheets of insulation in such a manner that one end of each of two adjacent coils overlaps the other without insulation, the pressure being sufficient to give good contact. Thus a complete circuit is formed. The coils are pressed against the pole-tips by means of wedges, and V-shaped pieces between the poles take up the component of the centrifugal force which would tend to pull the coils apart. The whole forms a remarkably solid and simple job.

The wire for the high-tension windings, and indeed for all large machines, is baked thoroughly before using, and kept in a warm dry storeroom until required. Mica on cloth forms the chief slot insulation, the layers of conductors in high-tension work being wound in separate tubes arranged in the mica trough.

The practice as regards impregnating varies considerably. Wire impregnated before using is rarely employed; in most cases the whole stator is dipped and baked, but on large machines with open slots the practice is to impregnate and insulate the coils before placing them in the stator, and we have seen coils wound in position taken out to be insulated and impregnated, and then replaced. One firm tapes up the coils with a coarse tape which has been previously treated with some bituminous compound. The result is a particularly porous article, but one which lends itself to very thorough impregnation and varnishing.

The taping is done by females; it has been found quite practicable to have both men and women working together on big machines, the men winding and the women taping.

On the whole, we are not favourably impressed by the insulation of the end connections of the stator winding, but the ample space which designers allow for their windings forms their factor of safety.

Forced ventilation of alternators is rapidly being adopted, and the axial cooling ducts already described are becoming almost universal in their use. The stator plates are invariably held by means of bolts arranged outside the magnetic circuit. Until recently makers did not make a standard line of medium-speed alternators for large outputs, slow-speed machines for coupling to slow-speed steam or gas engines and high-speed machines for coupling to water and steam turbines being the rule.

The exciters are specially designed, and for direct-coupled units are fitted with an abnormally large number of poles for their output. Compounding of alternators is carried out by all firms, even on medium-sized units.

Turbo-alternators.—No stator cases are made split on the horizontal centre line now, and, further, all large units are so arranged that the hot air from the stator is not delivered into the engine house, but is driven outside the building. Stator plates are held together by bolts, and are arranged with axial ventilation ducts. The winding of the stator coils is done by hand by most makers, the only formers for winding the end connections being the supporting clamps themselves.

The winding is otherwise the same as on slow-speed alternators, except that we did not see female labour employed here.

There are several interesting types of rotor construction; each firm has its own design.

Rotor by Firm A.—The rotor is cylindrical, with a distributed winding. The hub or core is one solid forging with the shaft, to which the teeth are attached as follows:—The teeth are built up of stampings in packets of about 6 in. length, so arranged that there is a clear space through from top to bottom on the middle 2 in. The packets are riveted together, and after being ground to size the rivet heads project about ¼ in. outside the packet, so that when the packets are placed together on the core a vent space of about ½ in. is formed.

The excitation coils are former wound, and while subjected to pressure each coil is enclosed in a metal casing which is soldered up, thus rendering the coils watertight (*i.e.*, non-hygroscopic) and affording excellent mechanical protection. The coils are laid on the core and the teeth packets slid into position on either side of the coils. These teeth slide in grooves milled out along the core, the grooves being deep enough to permit a current of air to pass under the teeth to the vent spaces. The coil ends are bound down to the core body by means of banding wire wound on by a special machine under tension. Over the first banding comes a bronze sleeve, and another banding on top of that. Copper wedges are driven over the windings in the slots, and steel wedges are arranged in the empty slots to take up lateral pressure. These wedges when driven in press down the coils into the core with a pressure greater than the maximum pull due to centrifugal force, and they also press the teeth packets against the grooves in the core so as to form good magnetic contact. The bronze sleeve short-circuits the copper wedges, which form amortisseurs.

Rotor by Firm B.—The core of this rotor is built up of steel plates with the slots already punched in. These slots are unequal in width and unequally spaced, the spacing being so arranged as to give the desired flux distribution curve without having any empty slots. In cases of large outputs the whole rotor is forged out of the solid and the slots milled out. In this case the slot is very deep, with a shoulder half-way down on which a metal lining rests to support the winding. The lower half of the slot thus forms an air channel directly under the winding. The coils are wound on the rotor, each coil being separated from the following one by aluminium packing pieces. Pressspahn slot insulation is used, and the coil in one slot is wound in layers, the layers being kept separate by a special compound put on hot. In addition to the aluminium packing there are L-shaped steel plates, the lower limb of the L fitting in grooves turned in the rotor hub. The interstices are all filled with compound, and a bronze ring is shrunk on over all.

Rotor by Firm C.—This firm adopts salient-pole rotors from four-pole upwards. They are usually built up of steel slabs (forged) approximately 3 in. thick, with forged-steel pole-piece slabs dovetailed into the hub. The windings are of copper strip wound on edge and insulated with pressspahn. Bronze angle-pieces hold the ends of the winding, and V-shaped packing pieces hold the coils in place laterally. The ventilation is through holes drilled in the slabs.

All rotors are dynamically balanced at a speed of about 50 per cent. above normal.

Exciters are specially designed, and in almost every case their armatures are carried by the extension of the rotor shaft without there being any additional bearings.

Steel slip-rings shrunk on over mica are used in conjunction with one carbon and two copper brushes to each ring. Standard practice is to arrange one ring at each end.

Turbo-Generators for Direct Current.—There is much less demand for this type of machine, and the principal variations from English practice which we observed are in the ventilation of the armature. Here again the axial ducts are used, as many as three rows being arranged concentrically. Field frames are usually built up of stampings. To avoid the use of very long commutators, these are now made in two halves and connected together.

Scientific Experimental Work in Factories.

Referring to the development of engineering since 1872, when Germany began her career as a Great Power, one finds that time and time again the Germans have taken up some design of an English engineer, and after a thorough investigation have devised important improvements. It is this thorough system of scientific investigation and experimental work that has enabled German firms to attain otherwise inaccessible eminence in certain branches.

There are several striking examples of this; perhaps the best known is the experimental high-speed railway, near Berlin, between Marienfeld and Zossen. Another example is the important series of investigations carried out on mining motors, a series with far-reaching results.

Less well known is the important test of the effect of heat and age on insulating materials carried out by one of the large firms. Samples of all kinds of insulation were kept at a constant temperature of nearly 100° C. for one year, some being kept under pressure. This experiment was of the utmost value to the firm concerned, but no results have yet been made public.

A considerable amount of plant has been laid down for experimental and special testing purposes, among the most recent being a water brake of 8,000 H.P. for testing steamship turbines at one works, and a wireless telegraph station at another works.

As an example of the application of scientific method to works practice may be cited the dynamic balancing of all rotors and armatures of high or extra-high peripheral speeds, as well as of all large size rotating parts while in the building-up stage.

Of course capital is required for these experiments; but as the German engineers are so well trained theoretically, and the German firms willing to employ them, the capital is rarely expended without some tangible profit. It is due also to these experiments that they are able to cope with special circumstances, and are able to train the experts referred to in the earlier portion of the paper.

They have proved to the satisfaction of their financial supporters that money spent on careful experiments in the hands of capable well-trained men is capital well invested, and we would like here to insert a plea for the further recognition and better payment of the specialist in our own country.

Conclusion.—We have carefully avoided mentioning, as far as possible, anything relating to the other important branches of the electrical industry in Germany, since a separate paper could be easily written on the management, manufacture and design in each individual branch. The majority of our general remarks, however, apply equally well to other branches, viz., switchgear, instruments, lamp and cable manufacture. It has been attempted in this paper to give a brief survey of the German industry in the manufacture of dynamo-electric machinery, with the idea of investigating the factors of German makers' success, both in the German and the open market. Summarised briefly, we have, first of all, their commercial enterprise, including good general management, close study given to any scheme or undertaking, and the judging of each one on its own merits; secondly, their large capital and the backing-up given them financially by the all-important banks. The large capital at their disposal assists them in their own country, and obtains for them good credit in foreign markets.

Coming to the manufacturing side of the industry, we consider the two shift system, together with cheap labour and the thorough system of specialising, the most important factors in competition. In design, England is in no way behind; in fact, in several cases, the English designers are more far-seeing, and their designs more practical than those of their German competitors.

If the English financiers and commercial leaders of the electrical industry were as enterprising and as successful as their German rivals, English manufacturers, supported as they are by the superiority of

their productions, would not have to fear German competition in the open market.

The discussion was opened by Mr. Emile Garcke, who said the importance of the subject only admitted of plain speaking.

The authors rightly emphasised the importance of the German financial conditions, but they did not take cognisance of all the facts; the last paragraph in the paper could not pass without criticism, as the views expressed there were not justified without further evidence. He (the speaker) unhesitatingly said that British commercial men were as enterprising as any, but they lacked profits and organisation. Despite low costs of production, they could not make sufficient profit to enable them to compete with protected countries. Importation would be on an even larger scale if it did not have the effect of reducing prices to an unremunerative level. English manufacturers could not offer enterprise a sufficient reward, and so could not command fresh capital. He had been instrumental in introducing many millions of capital into the electrical industry, and it was quite unnecessary to demonstrate that the profits were too low—the figures were published. Organisation was necessary to progress, and he blamed the Institution for devoting so much time to scientific discussion, to the neglect of legislative and commercial matters. We had no organisation which could speak for the whole industry on legislative and financial matters, and in urging that the I.E.E. should devote more time to these, he appealed to the President for assistance in this direction during his period of office. Scientific and commercial matters were closely allied, and they must be considered together.

The President (Dr. Kapp) warned members not to introduce politics into the discussion, remarking that the Institution was a technical and scientific body.

Mr. W. Rutherford (Dick, Kerr & Co.) intimated that he would not speak, in view of Mr. Garcke having said all that he had intended to say, and of the President's remarks.

Prof. S. P. Thompson thought it would require a lengthy experience in a foreign country to enable one to discriminate as to novelties; he was inclined to think that many things noticed could be attributed to natural development. The two-shift day and no overtime must make an enormous difference in favour of the German manufacturer, but it was probable that the industrial conditions were not the same all over Germany. It did not appear possible to state conditions *en bloc*, and so it was possible to draw incorrect conclusions from a perfectly true statement. Some years ago he had pointed out that manufactures were a reflex of the conditions under which they were produced. We had had to grow our electrical manufactures in the face of the opposition of commercial and industrial men, who ought to have known better. He regretted that there was a tendency in this country to regard the theoretical and scientific work of the factory as unproductive labour.

Mr. J. S. Raworth said that he had read the conclusion of the paper first of all, and did not agree with it. In the early days he had been associated with Mr. Garcke, who had been accused of making a political speech, although he (the speaker) did not know how it could be avoided. Speaking of the English electrical industry in the early eighties, he said that they went to Germany and installed the first electric street lighting; they also equipped a cotton mill and installed 1,260 lamps at the Vienna Opera House, among other work, and yet they were accused of being uninterprising. It looked then as if Germany would offer great opportunities to British engineers, but the German tariff had altered all that. Contrary to the authors' statements, the German banks were father and mother to the works. The Germans had brains, cheap labour and protection, and were able to build up big businesses.

Mr. A. A. Campbell Swinton said the Institution was to be congratulated on its first commercial paper, which appealed to him. He was rather struck by the President's remark on the previous night that we were "not behind Germany." This was scientifically correct, but the instance mentioned, that we supplied electricity at a less price, had no connection; if we made it cheaper, there might be something in it. The real criterion was our ability or inability to make profits. Searching for reasons for our inability to make fair profits, he suggested that the Board of Trade returns gave too much publicity to costs, which were not disclosed in other commercial concerns. Further, to his mind, a most important factor was the insidious form of Socialism known as municipal trading. The municipalities set the pace as regards costs, and they could borrow money very cheaply, which, although good for the consumer, was not so for the supplier. He could not see the good of enterprise when there were no profits and it was, therefore, not possible to raise capital. Additional capital subscribed to the municipal electrical industry was buried under "Municipal stock," which, as far as the investor was concerned, might be for gas or sewers, and he thought that if people knew of the success of electrically-invested capital they would come forward. Newcastle-on-Tyne, he pointed out, had always been served by companies, and its success was well known; it was an electrical centre, and capital was always obtainable for developments.

Mr. W. M. Mordey expressed the view that the only safe course for the Institution was to confine itself to engineering and science, and to avoid financial questions, except in so far as they were engineering and not political questions. Of course, profit-making was a branch of engineering, but the Institution must not allow itself to be made a trade protection society. He thought manufacturing, in some branches, had been unprofitable, because capitalists had put up too many factories, and although there was a great deal of work, there was not enough for all at remunerative prices. It was not correct to state that the Institution had not taken action in connection with the recent legislation. Although it had not advertised the fact, it had had a committee working at the subject, and had sent a deputation of the Council to the Board of Trade. He did not believe in the charge of lack of initiative in this country, and thought the difficulty of getting financial support for electrical enterprises was mostly felt by those whose work had been unsuccessful.

Mr. T. Rich asked why it was that in the case of, say, the Victoria Falls scheme our engineers had had to stand aside. A matter such as this was decided between financiers before the technical men got a look in. The fact was the English engineer had no one to back him up, although he would succeed as well as any engineer, if supported. We found, however, that Chicago, Buenos Ayres and Yokohama were nearer to the London money market than the English electrical industry. The backwardness of our development, as compared with Germany, was largely due to British legislation, which favoured obstructive tactics and unnecessary expense.

Mr. A. R. Stelling, in reply, said that the English manufacturer would not study local conditions, and English agents frequently relied on a good name, while the German went after the work. English firms did not maintain adequate staffs in foreign countries; he knew of one German firm which had a staff of 14 in China. German progress was very marked in India, where their trade had increased 50 per cent. in value during the past year. In Germany it was illegal to issue shares of a less value than £50, and this, of course, tended to keep out the smaller capitalist, leaving the business in the hands of the wealthy. During the past year the Germans had all complained of the effects of restrictive legislature, but despite this had paid higher dividends, and he thought this could only point to expanding trade abroad. In no other country in the world was there such a collection of foreign manufacturing firms as in Britain, and these firms were responsible for the undercutting of prices.

The Present Aspect of Electric Lighting.

The paper on this subject by Messrs. Handcock and Dykes (Electrical Review, December 3rd. p. 912), and a paper on "Metallic-Filament Lamps," by Mr. F. H. Lavender, M.Sc., were read at the meeting of the Birmingham Local Section of the Institution of Electrical Engineers on December 1st, and were discussed together. An abstract of the latter paper will appear in our next issue.

Dr. Sumpner said it was not only of importance to know that a lamp was at its best efficiency at one particular voltage, but also to know how far one could go from that figure before any serious change in efficiency took place. So also with regard to the most economical life, which was given as 1,500 hours. With carbon lamps the efficiency fell off considerably and the smashing point was fairly well defined, but with metal-filament lamps the efficiency was much more nearly constant, and, in fact, the best thing to do was to run them until they broke.

Mr. Maurice Solomon agreed with Dr. Sumpner that the curves showing the economical life did not give much information because they did not bring out clearly the difference it made whether the economical life were exceeded or not. There was another disadvantage—that they arrived at a conclusion which it was impossible to carry out in practice. There were two natural limits which determined the running limit in practice. One was the lamp breaking, and the other was the candle-power falling till it was no longer sufficient for the purpose for which it was required. Such considerations gave something like double the economical life as calculated by curves like those in the paper. Most of the curves in the paper represented the results obtained on a single lamp, but some of the curves given showed that the results obtained with lamps of the same make varied very widely in practice. The curves showed that makers for the most part rated their lamps very closely to the point giving the best results. It was very desirable that a uniform system of plotting such curves should be adopted. To enable comparison to be easily made, the percentage variation in candle-power should be plotted and not the actual variation.

Mr. Lindsay Forster said that a large amount of space had been given to the tantalum lamp as compared to the tungsten, but he thought that there were differences between the various makes of tungsten lamps which should have been brought out. The wire lamp would be a great factor in popularising the electric light.

Mr. R. Ornstein said that the small consumer who used the penny-in-the-slot system for his gas would not be in a position to pay 15s. or 20s. all at once for his electric light per quarter. So long as he only used three or four lamps he would prefer to go on using the light which he could buy with his pennies. In the case of a better class of consumer with 10 or 15 lamps, he could not agree with the statement that 80 per cent of these lamps came on at the worst time; the figure would be nearly 35 per cent. The present price charged by some stations could not possibly pay. From his experience, between 4d. and 4½d. should be charged. It would be impossible for a consumer with 10 or 15 lamps to pay at the rate of 12s. each. At present the charge in Aston worked out at something like 3s. per lamp per year, without taking into account the lamp itself; assuming the life to be 1,500 hours the lamp would last three years. Another disadvantage would be that it would handicap the extension of lighting in any house. The position of central stations was very unfavourable at the present time. His view was that before canvassing the consumer who used only three or four lights there was plenty of scope for those who would put down 10 or 15 lamps, and these consumers would not come upon the station up to the 80 per cent. limit at the worst moment. He considered that the question of canvassing had not been properly tackled, and there was a very large scope for electricity in other directions besides light.

Mr. A. G. Needham noticed that the candle-power of the lamps rose at first. The aim of the maker usually was to get as near the maximum as possible before he sent the lamp out, and to do this most makers aged their lamps considerably. The irregularities shown in the curves were much more likely to be due to changes of measurements than to variations in candle-power. Manufacturers rated their lamps at the best point in order to obtain long life.

The Chairman (Mr. M. Railing) remarked that his experience had been that the metal-filament lamp had helped to extend and increase the output in certain stations. To his mind, the problem was not so much to get an increased price from consumers as to get more of them, and that was a matter in which manufacturers should be able to help the station engineers by supplying a small candle-power lamp.

Mr. R. Milne gave some figures with regard to the electricity department's revenue in Birmingham. The growth of revenue in regard to sales had been as follows: In one year they had a 5 per cent. increase, the next year 10 per cent., the next year about 17 per cent., and this year about 27 per cent. They must also remember that, even if there was only a small increase in current, there was a much larger increase in candle-power. In connection with the first paper, some allowance should be made for the voltage variation on town mains. They found, in the centre of the town, where the consumer was near to the central station, that it was advisable to put in 240 or 235-volt lamps, while on the outskirts 230-volt lamps had to be employed. Some of these new lamps were wrongly marked by the makers. A consumer recently complained of the premature failure of his lamp, so they got a dozen he had just purchased from the maker and tested them. They were all marked 110 volts, but they found that if they had been correctly marked, the voltage should have ranged from 87 to 114. Some years ago he had tried the contract system on a block of small houses, charging 6d. a week in summer, and 1s. a week in winter. Each house contained five lights, and the revenue from the current supplied worked out at something like 1¼d. per unit. They had experimented in Birmingham on the lighting of small houses with prepayment meters. After about eight months' running, the consumers were quite satisfied. They charged 5d. per unit, which covered service charges, meter rent and cost of current. The consumer was satisfied, because he got a better light than previously with a 60-c.p. gas mantle, and the cost of current was lower than the cost of gas for the same light. The great thing with these small houses was to get paid in advance. If they let a man run for over two weeks, it meant a moonlight flit, and he usually took the lamps with him when he went.

Mr. Fennell (Wednesbury) thought that station engineers became unduly alarmed if their revenue for one year showed signs of coming down. He thought that they ought to be prepared to experience one or two lean years, because they were on the threshold of an enormous boom. He had prepared figures taking the output of the last Saturday in November for the past five years; in 1904-5 there was a considerable increase, in 1906 not a very large increase, in 1907 a considerable increase, 1908 was lower than 1907, and in 1909 the peak was just double that of 1908. There was one class of long-hour consumer hitherto neglected who could profitably be approached, *i.e.*, the big brewery companies; these were now seriously considering the adoption of electricity for lighting throughout their houses. During the last week he had fixed up with one company for two houses and with another for three, and they had several other cases where they were giving supplies with very good results. The contract system rather departed from the Englishman's idea of business, as he was used to buying by measure. To tell people to buy at so much per year conflicted with their ideas of justice, and would create, especially in small towns, a great deal of dissatisfaction. The short-hour consumer would have a grievance against the long-hour consumer. They had fairly good meters and could buy them cheaply—really 10s. 6d. for a meter was not a serious matter. The complication of meters and the work involved would be nothing to the complication of the system of house-to-house visits that would be required.

Mr. Handcock, in reply, pointed out that the system advocated in his paper had already been fully tried in connection with water supply, and as regarded electric light, it had been in use for some little time past at Harrogate, and some other places. At Harrogate it was so successful that its use was being rapidly extended. The consumers appreciated it, and the station found it paid. As regarded putting in higher candle-power lamps than those originally fitted, that was stealing electricity, which was a felony, and could be guarded against by the use of special sockets and lamps. They contended that the long-hour consumer had grave cause for complaint against the electric light undertakings, who were taking a profit from him that was absolutely unjustified. Station engineers ought to be honest with the long-hour consumer, and as soon as he paid anything like 12s. a light or more, they ought to offer him a supply on a contract basis, or give him something in reasonable proportion to the aid he gave the station. The Board of Trade Returns showed that the gas profits were not made from the big consumers; the average yield per gas consumer was somewhere in the neighbourhood of £5. If the gas undertaking looked to the small consumer for its profits, he thought that they should look in that direction also. He knew of one or two cases where the lighting charge was collected with the rent, an arrangement which had several advantages. Although some stations had maintained their normal output in spite of the introduction of the metal-filament lamp with its increased standard of illumination, there were very many which had suffered a slight setback. On the other hand, they all realised that the setback was only a temporary one. He would be glad if Mr. Fennell could give some information as to the effect of the metal-filament lamps' load not only on the magnitude, but also on the shape of the peaks; in some cases they had found that the peaks had diminished, in others they had increased, but the output did not increase in proportion to the maximum load.

Mr. Fennell remarked that in his case the effect had been to flatten the curves, owing to the long-hour consumers they had been able to obtain.

THE ELECTRIC LIGHTING ACT, 1909.

The terms of this Act, which comes into force in April next, are as follows:—

1.—(1) The Board of Trade may by Provisional Order authorise any local authority, company, or person, who is authorised by the same or any previous Provisional Order or by Act of Parliament to supply electricity in any area, to acquire compulsorily, or to use, for the purpose of a generating station any land specified in the Order, whether situated within or without the area of supply, and, in the case of a local authority, whether situated within or without their district.

2. For the purpose of the acquisition of land authorised to be taken compulsorily under any such Provisional Order, the provisions of the Lands Clauses Acts which relate to the purchase and taking of lands otherwise than by agreement, and to the entry upon lands by the promoters of the undertaking, are, subject to the modifications set out in the First Schedule to this Act, incorporated with the Electric Lighting Acts, as well as the provisions of those Acts already so incorporated by the Electric Lighting Act, 1882.

3. Rules made by the Board of Trade under Sec. 5 of the Electric Lighting Act, 1882, shall provide for proper notice being given of an application for a Provisional Order, by which it is proposed to authorise the compulsory acquisition or use of land for the purpose of a generating station, to owners, lessees, and occupiers of land, and also for public notice being given of the proposal by advertisement.

2. It shall not be lawful for any undertakers after the passing of this Act, except with the consent of the Board of Trade, to construct any generating station on any land acquired by them after March 31st, 1909, unless the construction is authorised and the land is specified in a special Act or Provisional Order, and the Board of Trade shall not in any case give such consent until notice has been given, by advertisement or otherwise, as the Board of Trade may direct, to the local authority of the district in which the land is situate, and to owners and lessees of land situate within three hundred yards of the land upon which the generating station is to be constructed, and an opportunity has been given to such local authority, owners, and lessees, of stating any objections they may have thereto.

This section shall not apply to any station for transforming, converting, or distributing electrical energy.

3. For the purpose of enabling electricity to be brought into an area of supply from a generating station belonging to any undertakers situated outside that area, the Board of Trade may by Provisional Order apply to any roads, railways, or tramways situated outside that area the provisions of the Electric Lighting Acts which authorise, or enable the Board of Trade to authorise, the breaking up of any road, railway, or tramway, so far as those provisions do not already so apply:

Provided that a Provisional Order authorising the breaking up of roads outside the area of supply shall not be granted by the Board of Trade except with the consent of the local authority in whose district the road is situate, unless the Board of Trade, in any case in which the consent of any such local authority is refused, are of opinion that, having regard to all the circumstances of the case, such consent ought to be dispensed with, and in that case they shall make a special report to Parliament stating the grounds on which they have dispensed with the consent.

4.—(1) The Board of Trade, unless they are of opinion that, by reason of the character or magnitude of the proposed undertaking, the matter ought to be dealt with by private Bill, may by Provisional Order—

(*a*) authorise any local authority or company to supply electricity in bulk;

(*b*) provide for any supply so authorised being compulsory; and

(*c*) make such other provisions as appear to them necessary for adapting the Electric Lighting Acts to any case where a local authority or company are authorised to supply electricity in bulk, including the application to roads, railways, and tramways along the route along which lines are authorised to be laid for the purpose of giving the supply in bulk of the provisions of those Acts which authorise or enable the Board of Trade to authorise the breaking up of any road, railway, or tramway:

Provided that a Provisional Order authorising the breaking up of roads outside the area of supply of the local authority or company by whom the supply is to be given shall not be granted by the Board of Trade except with the consent of the local authority in whose district the road is situate, unless the Board of Trade, in any case in which the consent of any such local authority is refused, are of opinion that, having regard to all the circumstances of the case, such consent ought to be dispensed with, and in that case they shall make a special report to Parliament stating the ground on which they have dispensed with the consent.

2. If the Board of Trade refuse to grant a Provisional Order under this section, on the ground that the matter ought to be dealt with by a private Bill, the notices published and served for the purposes of the proposed Order shall, subject to the Standing

Orders, be held to have been published and served for a private Bill applying for similar powers:

Provided that the applicants for the Order shall, by notice served in the prescribed manner and within the prescribed time, inform all opponents of their intention to proceed by way of private Bill, and, subject to Standing Orders, the application for a Provisional Order shall be deemed and taken to be a petition for leave to bring in a private Bill, and the applicants shall also give such additional notice (if any) as may be required by Standing Orders.

3. The Board of Trade may, if they think fit, by order permit any undertakers to supply electricity in bulk to any other undertakers upon such terms and subject to such conditions as may be specified in the order, if the supply can be given without breaking up any streets except such as the undertakers giving, or the undertakers receiving, the supply are authorised to break up; but the Board of Trade shall not in any case make such an order until notice of the intention to make the order has been given by advertisement or otherwise as the Board of Trade may direct, and an opportunity has been given to any person who appears to the Board to be affected, of stating any objections he may have thereto.

5.—(1) Any local authority, company, or person authorised to supply electricity in any area may, with the consent of the Board of Trade, supply at any point within that area electricity for the purposes of haulage or traction on any railway, tramway, or canal situate partly within and partly without that area, and for the purposes of lighting vehicles and vessels used on any such railway, tramway, or canal; but the Board of Trade shall not in any case give any such consent until notice of the application for the consent has been given by advertisement or otherwise in such manner as the Board of Trade may direct, and an opportunity has been given to any person who appears to the Board to be affected of stating any objections he may have thereto.

2. The Board of Trade may, by Provisional Order, authorise any such local authority, company, or person so to supply electricity to be used for purposes incidental to the working or lighting of the railway, tramway, or canal, other than the purposes aforesaid.

3. A company, local authority or body receiving a supply of electricity under this section shall not use the electricity in such manner as to cause, or to be likely to cause, any interference with Government observatories or laboratories, or observatories or laboratories now or hereafter erected, owned, or managed in pursuance of any present or future statutory enactment, but this sub-section shall not apply to any such company, local authority, or body who, by any Act of Parliament or Order confirmed by or having the effect of an Act of Parliament containing provisions for the protection of such observatories or laboratories, are authorised to use electricity for the purposes for which a supply is authorised to be given under this section.

6.—(1) Where it is proved to the satisfaction of the Board of Trade that the occupier of any premises is desirous of obtaining a supply of electricity from any undertakers within whose area of supply those premises are not situate, the Board of Trade may if the local authority within whose district the premises are situate, and the undertakers (if any) authorised to supply electricity to such premises, consent, by order permit the first-mentioned undertakers to give a supply to those premises on such terms and subject to such conditions as the Board think fit:

Provided that, if in the opinion of the Board of Trade any consent required by this sub-section is unreasonably withheld, the Board of Trade may proceed as if such consent had been given.

2. An order given by the Board of Trade under this section may, for the purpose of enabling a supply to be given thereunder, confer any such powers and impose any such duties on the undertakers as would have been conferred or imposed by the Electric Lighting Acts, and as might have been conferred or imposed by Provisional Order if the premises and the route along which lines are to be laid for the purpose of giving the supply were within the area of supply of the undertakers, anything in the special Act or Order relating to the undertaking to the contrary notwithstanding.

3. If the undertakers on whom powers are conferred by an order under this section are not a local authority, the works and lines erected and laid under the powers so conferred shall, so long as the order remains in force, be deemed, for the purposes of the provisions as to purchase applicable to the undertaking, to form part of the undertaking within the district of the local authority which comprises the area of supply of the undertakers, or, if that area is comprised within the districts of more than one local authority, within such of those districts as the Board of Trade may determine.

4. Nothing in this section shall enable the Board of Trade, without the consent of the undertakers within whose area of supply the premises are situate, to give such permission as aforesaid to any undertakers where the last-mentioned undertakers are by any Act of Parliament specifically prohibited from supplying electricity within the area of the first-mentioned undertakers.

7.—(1) Where any generating station, mains, or other works of a company used solely for supplying electricity within the district of a local authority are situated outside the district of that local authority, the generating station, mains, and other works so used shall for the purposes of the provisions of the Electric Lighting Acts, and any Provisional Order conferring on local authorities power to purchase undertakings, be deemed to be situated within the district of that local authority, and, where any generating station, mains, and other works are used solely for supplying electricity within the districts of two or more local authorities, but are not situated within any of those districts, the Board of Trade may, on the application of all or any of those authorities, by Provisional Order apply this provision subject to such adaptations as the circumstances of the case may require:

Provided that this sub-section shall not, except by agreement between the local authority and the company concerned, apply to any generating station, mains, or other works authorised by a special Act passed before the passing of this Act.

2. Any local authority having power under the Electric Lighting Acts or any Provisional Order to purchase so much of the undertaking of a company as is within the district of that local authority may, with the consent of and upon such terms and conditions as may be approved by the Board of Trade, and, in the case of an undertaking authorised before the commencement of this Act, with the consent of the company, transfer their rights of purchase to any other local authority having power to purchase so much of the same undertaking as is within the district of that last-mentioned local authority, and the deed of transfer may contain such consequential provisions as may be necessary for giving effect to the transfer.

8. The Board of Trade may, with the concurrence of the Local Government Board, by Provisional Order make such provisions as appear to them necessary or expedient, by the constitution of a joint committee or joint board or otherwise, for the joint exercise of all or any of the powers under the Electric Lighting Acts, or this Act, or any Provisional Order, by two or more local authorities as respects any area of supply consisting of the whole or parts of the districts of those authorities, in any case where it appears to them that the joint exercise of those powers would be expedient, and any such Provisional Order may contain such provisions as may appear necessary or proper for adapting any of the provisions of the Electric Lighting Acts, or this Act, or any such Provisional Order, to the case of any committee or board so constituted.

9. The Board of Trade may grant a Provisional Order notwithstanding that the notice required by section four of the Electric Lighting Act, 1882, to be given to a local authority on or before the first day of July, has not been given in the case of any local authority which waives its right to receive such a notice, and no such notice need be given to the local authority of a district in which it is not intended to take power to distribute electricity.

10.—(1) With a view to making five years the ordinary period of revision of maximum price and allowing representations as to revision to be made by consumers, Sub-sec. (2) of Sec. 32 of the schedule to the Electric Lighting (Clauses) Act, 1899, shall, for the purpose of incorporation with any Act or Order passed or confirmed after the passing of this Act, be read as if the words "five years" were substituted for the words "seven years," and the words "or such number of consumers, not less than 20, as the Board of Trade consider sufficient, having regard to the population of the area of supply," were inserted after the words "either the local authority or the undertakers."

2. Where any Act or Provisional Order passed or confirmed before the commencement of this Act enables the Board of Trade to revise or vary any maximum prices to be charged for electricity, that Act or Order shall be construed—

(*a*) So as to enable the revision or variation to take place at an interval of five years after the commencement of the Act or Order, or the last revision, in cases where a longer interval is fixed by the Act or Order; and

(*b*) so as to enable the power of revision or variation to be exercised on the representation of such number of consumers, not less than 20, as the Board of Trade consider sufficient, having regard to the population of the area of supply, in cases where under the Act or Order such a power either cannot be exercised on such a representation, or can be exercised only on the representation of a number of consumers greater than 20.

11.—(1) The sections set out in the Second Schedule to this Act shall be substituted for Secs. 49, 50, 51 and 53 of the schedule to the Electric Lighting (Clauses) Act, 1899, as incorporated with any Act or Order passed or confirmed after the commencement of this Act.

2. The provisions contained in the sections so set out shall, subject to such adaptations (if any) as may be necessary, be substituted for any corresponding provisions as to the use, examination and certification of meters, and their connection and disconnection with electric lines, contained in or incorporated with any special Act or Provisional Order relating to the supply of electricity passed or confirmed before the commencement of this Act.

12. For the purposes of Sec. 9 of the Electric Lighting Act, 1882, the accounts of any undertakers being a local authority shall be made up to March 31st in each year, and accordingly as respects those accounts June 30th shall be substituted in that section for March 25th, and March 31st for December 31st: Provided that, if any such undertakers show to the Board of Trade that some other dates are, owing to special circumstances, more convenient in their case than March 31st and June 30th, the Board of Trade may substitute such other dates for March 31st and June 30th, and this section shall as respects those undertakers be construed with the substituted dates.

13. The Board of Trade shall from time to time make a return to Parliament giving such particulars as they may think proper with regard to the reports made by any auditors appointed by them to audit the accounts of any undertakers, and any action taken on such reports by the Board and by the undertakers.

14.—(1) A local authority, company, or person who have obtained a licence, order, or special Act for the supply of electricity shall not, by transfer or otherwise, divest themselves of any of the powers, rights, or obligations conferred or imposed upon them by the Electric Lighting Acts, or by any licence, order, or special Act, otherwise than under and in accordance with a

provision contained in a licence, order, or special Act authorising such a divestiture.

2. Sec. 11 of the Electric Lighting Act, 1882, shall be repealed from "but no local authority" to the end of the section.

15. Notwithstanding anything in the Electric Lighting Acts or in any Act of Parliament or Provisional Order authorising an undertaking, a person shall not be entitled to demand or to continue to receive from undertakers authorised to supply electricity in any area a supply of electricity for any premises having a separate supply, unless he has agreed with the undertakers to pay to them such minimum annual sum as will give them a reasonable return on the capital expenditure, and will cover other standing charges incurred by them in order to meet the possible maximum demand for those premises; the sum to be so paid shall be determined in default of agreement by arbitration.

16. All electric lines, fittings, apparatus, and appliances let by any undertakers on hire or belonging to any undertakers, but being in or upon premises of which the undertakers are not in possession, shall, whether they be or be not fixed or fastened to any part of any premises in or upon which they may be situate, or to the soil under any such premises, at all times continue to be the property of, and be removable by the undertakers, and Secs. 24 and 25 of the Electric Lighting Act, 1882, shall extend and apply to all such electric lines, fittings, apparatus, and appliances: Provided that such electric lines, fittings, apparatus, or appliances have upon them respectively a distinguishing metal plate affixed to a conspicuous part thereof, or a distinguishing brand or other mark conspicuously impressed or made thereon, sufficiently indicating the undertakers as the actual owners thereof.

For the purposes of this section, electric lines, fittings, apparatus, and appliances disposed of by the undertakers on terms of payment by instalments shall, until the whole of the instalments have been paid, be deemed to be electric lines, fittings, apparatus, and appliances let on hire by the undertakers.

Nothing in this section shall affect the amount of the assessment for rating of any premises upon which any electric lines, fittings, apparatus, or appliances are or shall be fixed.

17.—(1) Twenty-four hours' notice in writing shall be given to the undertakers by every consumer before he quits any premises supplied with electrical energy by the undertakers, and, in default of such notice, the consumer so quitting shall be liable to pay to the undertakers the money accruing due in respect of such supply up to the next usual period for ascertaining the register of the meter on such premises, or the date from which any subsequent occupier of such premises may require the undertakers to supply electrical energy to such premises, whichever shall first occur.

2. Notice to the effect of this section shall be endorsed upon any demand note for charges for electrical energy.

18. The undertakers may refuse to supply electrical energy to any person whose payments for the supply of electrical energy are for the time being in arrear (not being the subject of a *bonâ fide* dispute), whether any such payments be due to the undertakers in respect of a supply to the premises in respect of which such supply is demanded or in respect of other premises.

19. Electrical energy shall be deemed to be goods, wares, or merchandise for the purposes of Sec. 59 of the Stamp Act, 1891 (which makes certain contracts chargeable with stamp duty as conveyances on sale), and also for the purposes of the exemption numbered three under the heading "Agreement or any memorandum of an agreement" contained in the First Schedule to that Act.

20. For removing doubts, it is hereby declared that so much of any Provisional Order or special Act, or of the Schedule to the Electric Lighting (Clauses) Act, 1899, as incorporated with any such Order or Act, as prohibits undertakers from associating themselves with any company or person supplying energy under any licence, Provisional Order, or special Act unless the undertakers are authorised by Parliament to do so, shall not be construed as prohibiting the undertakers from taking a supply of electricity in bulk from any company or person authorised to give such a supply.

21. Money borrowed under the Electric Lighting Acts shall not be reckoned as part of the total debt of a local authority for the purpose of any limitation on borrowing under the enactments relating to borrowing by the local authority.

22.—(1) With a view to the protection of the royal palaces, parks, and gardens, museums, and other public buildings, and their contents (in this section referred to as "the protected premises"), the Commissioners of Works and their engineer, or other officer duly authorised in writing under the hand of their secretary, may from time to time enter upon and inspect any generating station of any undertakers, and, if on such inspection it should appear to the Commissioners that proper precautions are not being adopted for the due consumption of smoke, and for preventing as far as reasonably practicable the evolution of oxides of sulphur, and generally for the prevention of nuisance in relation to the protected premises, they may, without prejudice to any other remedy, require the undertakers forthwith to carry out such works and to do such things as are necessary in the circumstances.

2. The undertakers shall give all reasonable facilities for such inspection to the Commissioners and their engineer or other officer as aforesaid.

3. Any dispute arising between the Commissioners and the undertakers in relation to any of the provisions of this section shall be determined by arbitration.

This section shall not apply to the station of the Westminster Electric Supply Corporation, Ltd., at Horseferry Road, in the City of Westminster.

23. Where in any area a local authority, company or person is authorised to supply electricity under Act of Parliament or under licence or Provisional Order granted under the Electric Lighting Acts, it shall not, after the passing of this Act, be lawful for any other local authority, company or person to commence to supply or distribute electricity within the same area unless such supply or distribution is authorised by Act of Parliament, or by licence or Provisional Order granted in terms of the Electric Lighting Acts, provided that this section shall not prevent any company or person from affording a supply of electrical energy to any other company or person where the business of the company or person affording the supply is not primarily that of the supply of electrical energy to consumers.

Provided also that this section shall not prevent any company who at the passing of this Act are empowered by their memorandum of association to generate electrical energy from affording a supply to a railway company for purposes incidental to that company's undertaking other than the conveyance of public traffic.

24. Nothing in this Act shall enable the Board of Trade by Provisional Order to authorise the compulsory acquisition of any land which, at the date of the first publication of the notice for the Order, belongs to any gas or water undertakers, and is used or authorised to be used by them for the purposes of their undertaking.

25. In this Act, unless the context otherwise requires—

The expression "Provisional Order" means a Provisional Order under the Electric Lighting Acts:

The expression "Electric Lighting Acts" means—

(*a*) As respects England and Ireland, the Electric Lighting Acts, 1882 and 1888; and

(*b*) As respects Scotland, the Electric Lighting Acts, 1882 and 1888, the Electric Lighting (Scotland) Act, 1890, and the Electric Lighting (Scotland) Act, 1902.

The expression "authorised" means authorised by Act of Parliament or Provisional Order.

The expression "area of supply" means any area within which any local authority, company or person is authorised to supply electricity.

The expression "undertakers" means any local authority, company or person authorised to supply electricity to whom the Electric Lighting Acts apply.

The expression "road" includes any street as defined by the Electric Lighting Act, 1882.

The expression "generating station" includes any station for generating, transforming, converting or distributing electricity.

The expression "to supply electricity in bulk" means to supply electricity—

(*a*) To any local authority, company or person authorised to distribute electricity to be used for the purposes of distribution; or

(*b*) To any local authority authorised by any general or special Act to undertake or contract for the lighting of streets, bridges or public places, to be used for the purposes of lighting streets, bridges and public places.

26.—(1) In the application of this Act to Scotland, the Secretary for Scotland shall be substituted for the Local Government Board as respects Provisional Orders relating to Scottish local authorities, and May 15th shall be substituted for March 31st, and the first day of August shall be substituted for June 30th. Sec. 99 of the Burgh Police (Scotland) Act, 1892, as applied by Sec. 44 of the Local Government (Scotland) Act, 1894, shall be read as if the words "subject to the provisions of the Electric Lighting Act, 1882, or any Act or Acts amending or superseding the same," were repealed.

2. In the application of this Act to Ireland, the Local Government Board for Ireland shall be substituted for the Local Government Board as respects Provisional Orders relating to Irish local authorities.

27.—(1) This Act may be cited as the Electric Lighting Act, 1909.

(2) This Act and the Electric Lighting Acts shall be construed together as one Act, and may be cited as the Electric Lighting Acts, 1882 to 1909.

(3) This Act shall come into operation on April 1st, 1910.

SCHEDULES.

First Schedule.—Modifications of the Lands Clauses Acts.

The following modifications shall have effect in the construction of the provisions of the Lands Clauses Acts incorporated by this Act for the purposes of the Electric Lighting Acts:—

(*a*) The expression "special Act" means the Electric Lighting Acts, inclusive of any Provisional Order authorising the compulsory acquisition of land, except that the period of three years mentioned in Sec. 123 Lands Clauses Consolidation Act, 1845, shall be calculated from the passing of the Act confirming the Provisional Order; and

(*b*) The expressions "the promoters" and "the undertaking" mean respectively the undertakers and the undertaking under the Electric Lighting Acts, and the expression "company" in the Railways Act (Ireland), 1851, the Railways Act (Ireland), 1860, and the Railways Act (Ireland), 1864, means the undertakers under the Electric Lighting Acts; and

(*c*) The expression "land" includes easements in or relating to land.

Second Schedule.—Sections to be Substituted for Secs. 49, 50, 51 and 53 of the Schedule to the Electric Lighting (Clauses) Act, 1899.

"49. The amount of energy supplied by the undertakers to any ordinary consumer under the Special Order, or the electrical quantity contained in the supply (according to the method by which the undertakers elect to charge), hereinafter referred to as 'the value of the supply,' shall, except as otherwise agreed between the consumer and the undertakers, be ascertained by means of an

appropriate meter duly certified under the provisions of the Special Order, and fixed and connected with the service lines in some manner approved by the Board of Trade.

"50. A meter shall be considered to be duly certified under the provisions of the Special Order if it be certified by an electric inspector appointed under the Special Order to be a meter capable of ascertaining the value of the supply within such limits of error as may, as respects meters of the class to which the meter belongs, be allowed by the Board of Trade, and to be of some construction and pattern approved by the Board of Trade, and every such meter is hereinafter referred to as a 'certified meter': Provided that, where any alteration is made in any certified meter, that meter shall cease to be a certified meter unless and until it is again certified as a certified meter under the provisions of the Special Order.

"51. An electric inspector, on being required to do so by the undertakers or by any consumer, and on payment of the prescribed fee by the party so requiring him, shall examine any meter used or intended to be used for ascertaining the value of the supply, and shall certify it as a certified meter if he considers it entitled to be so certified, and the inspector shall, on the like requisition and payment, examine the manner in which any such meter has been fixed and connected with the service lines, and shall certify that it has been fixed and connected with the service lines in some manner approved by the Board of Trade, if he considers that it is entitled to be so certified.

"53. The undertakers shall not, nor shall any consumer, connect any meter used or to be used under the Special Order for ascertaining the value of the supply with any electric line through which energy is supplied by the undertakers, or disconnect any such meter from any such electric line, unless the one has given to the other not less than 48 hours' notice in writing of the intention to do so, and the undertakers, or any consumer acting in contravention of this section, shall be liable for each offence to a penalty not exceeding forty shillings."

THE CARE OF A COMMUTATOR.

[COMMUNICATED.]

John Pain Lumley had been designing direct-current machines for 23 years, and recollection of this circumstance never failed to awaken in his breast feelings of the liveliest gratification.

Events move quickly in the electrical world, and 23 years is a long time, viewed from the standard of progress made. Lumley well knew that there could be few men in the country who had been designing for that length of time; and he reckoned that he had succeeded in reaching the top rung of his ladder; that what he didn't know about his job wasn't fit to know.

From a primitive shunt-wound generator he had proceeded by sure stages to the latter-day refinements of the compound winding, the commutating pole, the ventilated spool, and the distributed field. Yes, he would think, as he leant back in his well-worn chair, he had not been idle.

He was wont sometimes to call to mind a machine he had designed with pride a couple of decades before. Big, ugly, wasteful, inefficient; bad in every respect! And then he would smile as he thought of his latest creature of the same output. Small, elegant, economical, efficient, good and sound all through. And all this the product of his brain. Then did he feel that the weary research, the restless nights, the crowded days, had not been spent in vain. He had evolved the finest D.C. machine which money could procure. Heating negligible. Commutation sparkless at heavy overloads.

Lumley, as a matter of fact, particularly prided himself on his knowledge of the subject of commutation. He had studied the question in all its bearings. He had published a work, running into three volumes, on "Reactance Volts, and How to Smother Them." A paper entitled "What's the Matter with Micanite?" stood to his credit in the annals of the local Society. Alternating-current men regarded him with envy, testers with awe. And the daily consolation of his hard-worked life was that he, John Pain Lumley, was the commutator king.

One day Lumley was called away to give expert advice on a job in the metropolitan district. In the station were a couple of his rotaries. He spent the morning clearing up the trouble, and was preparing to depart. As he was putting on his gloves he noticed how the marble panels gleamed; how the brass rails which hemmed in the machines sparkled in the sunlight. But the circumstance which most engrossed his attention was the sparkless, perfect operation of a couple of steam-driven generators. He called the attention of the switchboard man to it.

"They are not our machines," said Lumley, "but they're operating wonderfully well. Full load?"

"Yes. Bit of overload, if anything," replied the central station man. "They are excellent machines, but, in my opinion, care of the commutator while in service is even more important than good design."

"You think so?"

"I do, indeed!" said the switchboard man, impressively.

Now, the fact is, this man, Paynter by name, was something of a wag. He thought that with all his learning, Lumley looked a bit of a fool. There was nothing of the man of the world about him, and he might easily be deceived. Paynter resolved that he would have him on. He would start gently, and then if he found Lumley was taking the bait, he would give him as much as he could swallow.

"Yes," he resumed, "I feel it to be true that a closely-worked-out design may be entirely wasted and rendered worthless by careless running. While, on the other hand, a machine, theoretically poor and of doubtful operating powers, may be so tended and cared for, have its way so smoothed for it, so to speak, that it may perform wonders in service."

"I think there may be a great deal of truth in what you say," said Lumley, much impressed with Paynter's statement and heavy delivery.

"May be?" echoed Paynter, going on with increasing confidence, "there undoubtedly is. Look at those two machines. How are they operating?"

"Perfectly!"

"Yes. And how many commutating poles did the designer put in?"

"None!"

"Exactly! And do they look under-rated?"

"By no means. Over-rated, if anything, to judge simply by the size."

"Just so. Then the question is," cried Paynter exultingly, "how is it done?"

"Careful attention, eh?" queried Lumley, athirst for information.

Paynter nodded impressively, feeling that now he could tell his man any old lie he liked.

He took Lumley by the lapel of his coat, and prodded him gently, the while he regarded him with an air of much mystery.

"Do you know how I do it?"

"No!" murmured Lumley.

"Shall I tell you?"

"Tell me!"

"Mutton fat!" Paynter almost hissed.

"Mutton fat?" gasped his listener. A breathless pause, and then, "Oh, I see! You take the fat and rub it on the commutator instead of an oily rag."

"It must be mutton fat!"

"Why mutton? Wouldn't beef do, or bacon, or pork?"

"Good heavens, no! I've tried all the fats there are—vegetable and animal, and mutton is the only wear. And, of course, *any* mutton fat won't do, you know."

"Oh, won't it!" said Lumley.

"Not by any means; you have got to pick your sheep very carefully." By this time Paynter had fairly got into his stride, and was wondering how far he should go with it.

"You must pick a sheep which has never had any illness, preferably a two-year-old, without blemish."

"A two-year-old without blemish!" repeated Lumley with the eagerness of a child.

"Yes, and by far the most important point is this: *Cut the fat away near the kidney!*"

"Heavens!"

"One inch from the outside edge of the kidney!"

And Paynter drew back a few paces to watch the effect of his startling communication upon the face of the ingenuous Lumley.

As for that worthy, the thought that he was being grossly deceived never once crossed his mind. True, he was a little surprised to find that after worrying over commutation for

20 years, he should come to be instructed by a stripling like this young chap. But his mind was a receptive mind. He was open to conviction. He seized the attendant by the hand.

"A two-year-old without blemish," he cried joyfully, "and cut the fat one inch from the kidney."

"That's it," said Paynter. "Do that and your sparking troubles are over for ever."

Paynter moved away to put the water on the cooking stove; and Lumley, with many fervent expressions of thanks, took his leave.

He indulged in many fine speculations arising out of his new knowledge. He decided that to the instruction card which the firm sent out with every motor should be added a clause on "Care of the Commutator." He would at once have exhaustive tests made, and when he had found his ideal mutton fat he would have it prepared to his instructions on a large scale. He would read a paper before the Society, "Some Notes on Sheep as Applied to Electrical Engineering." What a stir it would create! What a boom for Lumley's reputation!

It happened that the very next day, when he got down to the office, he found a letter awaiting him from a man in charge of a gang on the outside staff. A 500-H.P. motor had been installed in a mill, and while the heating was well inside the guarantee, the commutation was simply shocking.

Wrote the outside man, "We have tried all possible adjustment of the brushes, checked up the pitch of the studs, adjusted all the springs, and, in short, done everything we can. Shall be obliged to you if you will write me at once, making any suggestions which occur to you as to next steps to take."

Lumley chuckled when he read this. This was where the mutton fat came in. He called for the stenographer.

"With reference to your letter of the 9th inst., and inquiry as to possible source of trouble in operation, I would advise the following procedure:—Apply to any vendor of British meat for some mutton fat, and note following particulars: The fat must be taken from a sheep at least two years of age, in perfectly sound condition at the time of slaughter, and this is most important—the fat must be cut away as near the kidney as possible—to be precise, one inch away. Raise the brushes, run machine round by placing men along the belt, and apply fat to the surface of commutator. This should clear up your trouble."

Serenely Lumley waited for the reply. It came the next day. The outside charge hand was a hard, cynical, common-sense man. "I have always known you to be a bally fool, but was not aware before that you were actually insane. Kindly note that I am not a blooming butcher!"

PROTECTION.

By R. M. M.

One sees and hears all kinds of woe-begone tales of unemployment, bad trade, bad prices, demand for Protection, or argument that Free Trade must be kept going for things to improve. Having had the pleasure of working for private companies in manufacturing business, in supply stations and in corporation undertakings, one conclusion the writer has come to is that protection is wanted, badly wanted—protection from ourselves.

All will grant that if the electrical business were better there would be a proportionately less amount of unemployment. Better trade means higher profits, more output, and, incidentally, higher salaries. Better business for supply companies, mark you, does not mean more units output, unless the extra units are sold at a decent margin of profit, immediate or in the near future. Better business for manufacturers does not mean larger output at a lower profit.

The station engineer recognises the first postulate, and quotes a five-year contract rate of supply to a large works with a decent margin for profits, or bases his tariff to bring in a margin—shall we say?—of over 15 per cent.

The manufacturer puts a price on his goods, and asks for something higher to be obtained to protect the trade; but then some of our station friends step in and say, "No, our consumers shall buy at your lowest price to us; we don't want to make any profit on the transaction." (What about the increased supply of juice with the margin for profit?) The station pats itself on the back and thinks the load is coming up nicely; other manufacturers hear the price quoted, and begin to worry how to cut their prices to the same or a lower figure. Wiring contractor A writes to the Review that some manufacturers sell to customers at a lower price or the same price as to himself, and the fat's in the fire.

No. 1 is selling, at practically no margin, through the supply station; Nos. 2 and 3 cut to this figure, and sell to the consumers. No. 1 has to drop, and so, *ad infinitum*, until the balance-sheets go wrong, and the cutting has induced cheap labour, and a consequent increase of unemployment.

There is a song which asks, "Little stranger, there's a danger. How's it all going to end?" (Who said Workhouse?)

The only one who as yet has not had any criticism is the contractor—his turn comes next. The contractor is no doubt well-meaning, but he also helps to upset things. A case has been heard of, where a contractor, who would ordinarily have his profit on wiring and a reserve on apparatus although the same was ordered direct, has actually cut the price quoted for the apparatus, thus giving away some of the reserve for nobody's benefit. Mixed motives, my masters!

We cannot find a grumble for the electrical Press, but certainly for the contributors. Some apparently desire that we should saddle ourselves with the horrors of Trade Unionism—to elevate the profession. "Ye gods!"

No, there is still a profitable lesson to be learned from America, which abbreviated is—Everyone electrical for everything electrical at all times, all working for electricity with eyes open to the benefit of the *whole* electrical profession.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

JAPAN.—The rates of duty given below are the lower rates which have been arranged by treaties with Japan. British goods are entitled to entry under these lower rates, but in order to gain this advantage they should be accompanied by a certificate of origin which is issued by the Japanese Consul in the place of origin. If no such officer exists, the certificates may be issued by the Custom House or other Government or public office, or by the Chamber of Commerce. The following is the form of invoice and certificate generally used:—

(Place and date.)

Invoice of .....

Marks.	Numbers.	Packages.	Quantity or weight.	Description of goods.

I (we) hereby declare that the above goods were produced in ....., and are to be shipped to Japan from the port of ..... per (ship's name) on or about the ..... day of ....., 19 .

(Signature.)

Certificate.

(Place and date.)

I hereby certify that ....., of ....., appeared before me and made the above declaration, and that I believe the same to be correct in every particular.

Signed and sealed this ..... day of ..... 19 .

(Signature.)

It is necessary that certificates of origin should be received by the consignee of the goods before the date of arrival of the vessel carrying the goods. Certificates from a Notary Public or an Honorary Japanese Consul will not be accepted. Certificates of origin can only be signed by a member of a firm or authorised agent, whose name must be registered at the Consulate.

Weight should be stated in kilograms to admit of conversion into Japanese weights; the net weight of the goods should be given on documents.

The dutiable value of an article subject to *ad valorem* duty is the actual cost of the article at the place of production or purchase with the addition of packing charges, cost of transportation, insurance and all other charges incurred up to the time of its arrival at the port of importation; however, in case of doubt, respecting the actual cost and the various charges, the balance after deducting the import duty from the price of the article at the place of importation is to be taken as the dutiable value thereof.

Yen = 2s. ½d. Kin = 1·32277 lb. Cattie = 1·32277 lb.

The following duties are payable:—

Asbestos, asbestos fibre or powder ...	10 % ad val.
Mica sheets	28·90 yen per 100 kin
Cloth or paper-backed mica, sheets of small size (about 2 × 2½ in.) ...	28·90 „ „
Mica, all other	10 % ad val.
Iron wire rod and small rod not exceeding ¼ in. in diameter: Of iron and mild steel	·503 yen per 100 catties
Of steel, other	1·819 „ „
Telegraph or galvanised wire: Of iron and mild steel	·259 „ „
Of steel, other	5 % ad val.
Rails: Of iron or mild steel	·129 yen per 100 catties
Of steel, other	5 % ad val.
Fishplates for rails	1·20 yen per 100 kin
Copper wire and round trolley wire	11·20 „ „
Copper plates and sheets	11 „ „
Brass and yellow metal: wire, plates, &c.	7·40 „ „
Babbit's metal and other anti-friction metals	3·50 „ „
Brass bars for turbine blades, corrugated boiler furnace tubes, flanged iron boiler plates	20 % ad val.
Bolts for rails, flat and round tie bars for rails	10 % ad val.
Dog spikes, plain	·578 yen per 100 catties
„ galvanised	10 % ad val.
Posts for electric wires, points for railways, line materials for electric railways, materials for railway turntables, portable rails, chairs for rails, railway signal apparatus	25 % ad val.
Telegraph wire, other than telegraph or galvanised wire, of iron, mild steel, or steel	5 % ad val.
Other submarine and underground cables and other insulated electric wire or cables, includes lead-covered aerial cables for telephone; lead-covered underground cables for telephone, for electric light (three-phase dynamo); lead-covered aerial cables for electric light (three-phase dynamo); insulated copper wire for electric light; insulated twist copper wire for electric light or telephone; submarine telegraph cables; underground cables for transmitting electric power (excluding three-phase dynamo); insulated electric wire cord (twisted or not) ...	20 % ad val.
Electric radiators	30 % „
Metal manufactures not mentioned ...	30 % „
Porcelain insulators	40 % „
Electric locomotives	5 % „
Wheels and axles, tires, &c., for locomotives	5 % „

(*To be continued.*)

How German Firms obtain Contracts.—A financial transaction, which promises to be accompanied by the prospect of a large amount of work in the future, is now being brought to a conclusion by the ALLGEMEINE Co., of Berlin. It relates to the acquisition from a holding company of shares of £375,000 in the Silesian Secondary Railway Co., whilst the remainder of the shares in the latter, amounting to one-fourth, are to be purchased from the shareholders directly. The Silesian company is associated with two or three other light railways or tramways, and the possession of the whole of the capital by the A.E.G. will enable the latter to proceed with the conversion of the lines to electric traction where steam locomotion is still used. The three-fourths (£375,000) of the share capital will be exchanged for shares of £75,000 in the Berlin Electricity Works Co., in which the A.E.G. held shares of £315,000 at the end of the financial year 1908-9.

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

28,429. "Electric switch with lever motion and instantaneous make and break." J. B. WYNNE. December 6th.

28,430. "Improvements in or relating to electric current leakage indicators." J. P. WINN. (Application for Patent of Addition to No. 4,666 of 1908.) December 6th.

28,462. "Improvements in inter-communication telephone instruments." J. A. ROMER. December 6th.

28,475. "Improvements in and relating to the driving axles of electrically-propelled vehicles." D. BALACHOWSKY and P. CLAIRE. (Date applied for under Sec. 91 of the Act, December 5th, 1908, being date of application in France.) December 6th. (Complete.)

28,532. "Improvements in electric detonators for explosives." J. H. ROBINSON and KYNOCH, LTD. December 7th. (Complete.)

28,545. "Commutator device for wireless telegraphic signalling stations." G. ERDMANN. (Application for Patent of Addition to No. 10,156, 1908.) December 7th. (Complete.)

28,555. "Electric arc lamp." L. M. MCBRIDE. December 7th. (Complete.)

28,557. "Combined electric bell push and paper knife." H. HIRST and S. D. WHITE. December 7th.

28,579. "Improvements in or connected with secondary storage cells or other batteries containing liquids." S. L. PRICE and J. G. PATTERSON. December 7th.

28,617. "Improved process of making homogeneous mechanical junctures between metallic bodies." G. HARRISON. (Electric Railway Improvement Co., United States.) December 7th. (Complete.)

28,672. "New or improved terminal for electric cables." G. CHARLTON. December 8th.

28,692. "Improvements in the manufacture of metallic incandescent bodies for electric glow lamps." B. DUKES. (Ges. für Verwertungs Chemischer Produkte m.b.H., Germany.) December 8th. (Complete.)

28,699. "Improvements in and connected with spark coils." E. WILSON and W. H. WILSON. December 8th.

28,758. "Improvements in apparatus for automatically operating the track points on electric tramways and railways." H. DUDGEON and H. CROSS. December 9th.

28,759. "Improvements in dynamo or motor brushes." W. CHRISTIE. (Galvanische Metall-Papier Fabrik Akt.-Ges., Germany.) December 9th.

28,762. "Improvements in the method of observing the effects of minute electric signals in a telegraphic system." C. C. F. MONCKTON. December 9th.

28,804. "Improvements in the electrical propulsion of ships." SIEMENS BROS. DYNAMO WORKS, LTD., and E. A. HOLMES. December 9th.

28,813. "Improvements in and connected with electric furnaces." E. WASSMER. December 9th.

28,818. "Improvements in and relating to electric ignition devices for internal combustion engines." H. BATT. December 9th.

28,825. "Improvements in telephone exchanges." SIEMENS & HALSKE AKT.-GES. (Date applied for under Sec. 91 of the Act, December 12th, 1908, being date of application in Germany.) December 9th. (Complete.)

28,849. "Improvements in and relating to arc lamp casings." R. BINET and G. GUENNE. (Date applied for under Sec. 91 of the Act, December 11th, 1908, being date of application in France.) December 9th. (Complete.)

28,861. "Improvements in and connected with metallic conduit systems used in electric wiring." SAUNDERS & TAYLOR, LTD., and J. V. PYATT. December 10th.

28,907. "Improvements in electric arc lamps." E. E. PRESTWICH. December 10th.

28,941. "Improvements in and relating to systems of electric motor control." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) December 10th.

28,942. "Improvements in or relating to burglar alarms and switch devices." S. LICHTENFELD. December 10th. (Complete.)

28,947. Improvements in or connected with electric indicating and measuring instruments." E. R. MURRAY. December 10th.

28,951. "Improvements in and relating to internal communication telephone systems." G. BURNEY and STERLING TELEPHONE AND ELECTRIC Co., LTD. December 10th.

29,004. "Improvements in or relating to electric control gear." CLARKE, CHAPMAN & Co., LTD., and R. C. HARRIS. December 11th.

29,020. "Improvements in trolley wheels for electric trams and the like." W. G. T. GOODMAN and W. KEON. December 11th. (Complete.)

29,026. "Improvements relating to electrical ignition apparatus for internal combustion engines." H. W. VAN RADEN. December 11th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1909.

SHADE CARRIER AS APPLIED TO ELECTRIC LAMP HOLDERS. W. Green. 3,250. February 10th.

ELECTRIC SWITCHES. W. H. Flood. 5,805. March 10th. (Cognate application, 15,211 of 1909.)

ELECTRIC SNAP SWITCHES. H. W. Lake. (Cutler Hammer Manufacturing Co.) 6,932. March 22nd.

STARTING AND REVERSING DEVICES SPECIALLY, THOUGH NOT EXCLUSIVELY, APPLICABLE TO ELECTRIC PULLEY BLOCKS. Electric Pulley Block Co. (Gese). 9,275. April 19th.

TELEPHONE SYSTEMS. M. S. Conner. 10,255. April 30th.

ALTERNATING-CURRENT DYNAMO-ELECTRIC APPARATUS. British Thomson-Houston Co. (Allgemeine Elektricitäts Ges.) 10,497. May 14th. (Application for Patent of Addition to No. 23,288 of 1902.)

ARRANGEMENT FOR UNIFORM AND RAPID ELECTROPLATING OF ARTICLES OF THE FLAT SHEET OR ROD TYPE. Langbein Pfanhauserwerke Akt.-Ges. 14,091. June 16th. (Date applied for under International Convention, June 22nd, 1908.)

ACTUATION OF CONTROLLERS AND THE LIKE FOR ELECTRIC MACHINERY. H. P. van Daalen. 15,203. June 29th.

ELECTRIC MOTOR STARTING-SWITCHES. Siemens Bros. Dynamo Works and E. Schupp. 16,537. 6 August 5th.